# Electrical World

The consolidation of ELECTRICAL WORLD AND ENGINEER and AMERICAN ELECTRICIAN.

VOL. 59. NEW YORK, SATURDAY, MARCH 30, 1912. No. 13.

PUBLISHED WEEKLY BY

## McGraw Publishing Company

JAMES H. MCGRAW, Pres. C. E. WHITTLESEY, Sec'y and Treas.

239 West 39th Street, New York

TELEPHONE CALL: 4700 BRYANT. CABLE ADDRESS: ELECTRICAL, NEW YORK.

CHICAGO OFFICE.....Old Colony Building
PHILADELPHIA OFFICE.....Real Estate Trust Building
CLEVELAND OFFICE.....Schofield Building
LONDON OFFICE.....Hastings House, Norfolk St., Strand

TERMS OF SUBSCRIPTION.

Subscription price in United States, Cuba and Mexico, $3 per year. Canada, $4.50; elsewhere, $6. Foreign subscriptions may be sent to the London office.

Requests for changes of address should give the *old* as well as the new address. Date on wrapper indicates the month at the end of which subscription expires.

NOTICE TO ADVERTISERS.

Changes in advertisements should reach the New York office ten days in advance of the date of issue. New advertisements are received up to Wednesday noon of the week of issue.

Copyright, 1912, by MCGRAW PUBLISHING COMPANY.
Entered at the New York Post Office as Second Class Mail Matter.

*The circulation of Electrical World for 1911 was 965,500. Of this issue 17,250 copies are printed.*

NEW YORK, SATURDAY, MARCH 30, 1912.

CONTENTS.

Editorials ..... 667
Transportation to Seattle N. E. L. A. Convention ..... 670
The Government and the Aluminum Interest ..... 670
Opening of the Cambridge Subway ..... 670
Minnesota Section, A. I. E. E. ..... 670
Street-Lighting Extension with Flame-Arc Lamps in Chicago ..... 671
Annual Report of the American Telephone & Telegraph Company ..... 671
Joint Meeting W. S. E. and A. I. E. E. ..... 673
Minnesota Electrical Association ..... 673
Convention of New England Section of the N. E. L. A. ..... 675
Monochromatic Light and Visual Acuity ..... 679
Defeat of Municipal Ownership at South Framingham, Mass. ..... 679
Enactment of Public Utility Law in California ..... 679
Public Service Commission News ..... 679
Current News and Notes ..... 680
Lake Shore Station of Cleveland Electric Illuminating Company ..... 683
The Utilization of Electricity in United States Coast Defense. By L. B. Bender, First Lieutenant Coast Artillery Corps, U. S. A. ..... 687
The Hysteresis Torque of Induction Machines. By Dr. Hans Riddervold ..... 690
New Central Station for Falmouth, Mass. ..... 691
Power Load in Louisville ..... 692
Energy Consumption in Electrically Equipped Bakery ..... 692
Electrically Heated Crematories ..... 692
A Direct-by-Mail House-Wiring Campaign ..... 692
Plotting a Consumption Curve for Each Customer ..... 692
Securing Co-operative Interest of Architects ..... 692
A Method of Investigating an Existing Rate Schedule for Motor Service. By F. B. Fletcher ..... 693
Application of Tirrill Regulator to Adjust Balance for Neutral Regulation at Distant Point ..... 695
Illuminated Church Sign ..... 695
Completion of Ornamental Cluster Post-Lighting System at Pasco, Wash. ..... 695
Recent Telephone Patents ..... 697
LETTER TO THE EDITOR:
Interior Wiring Costs. By Leo Dolkart ..... 697
Digest of Current Electrical Literature ..... 698
Book Reviews ..... 702
New Apparatus and Appliances ..... 703
Industrial and Commercial News ..... 709
Personal ..... 712
Weekly Record of Electrical Patents ..... 718

### ELECTRICITY IN COAST DEFENSE.

The article by Lieut. Bender, U.S.A., elsewhere in our columns, gives a strong impression of the practical importance of electricity in the coast-defense service. The extensive use of electricity here is the growth of recent years, although the principles applied have been familiar and utilized in a small way for a good many years. It took the Spanish war to bring this country to a full realization of the real significance of coast defense. Since that period many modern forts have been erected and equipped, and the full resources of applied science have been utilized in making these fortifications efficient and ready for business. The next threat of hostilities will not find guns without sights, magazines without shell, mine cases without available explosives to charge them, and batteries without range-finders or communications. From the standpoint of general design, military electrical plants are characterized chiefly by extreme subdivision. The works which defend a fortified city are scattered batteries carefully organized for efficient cooperation, but necessarily independent in the sense that any one of them may conceivably fall into the enemy's hands or be cut off from the others. The central power plant and the central system of communications in which the efficiency of the parts is dependent on the integrity of the whole are quite out of the question; hence the many small individualized power plants, a few driven by steam engines, most, however, operated by gasoline engines. The gasoline engine is peculiarly adapted to this service because it can be more easily protected from gunfire and need not betray its position by any provisions for the smokestack which would be necessary with steam plants. Almost every part of the electrical equipment in the coast-defense system has gradually been specialized, starting as a rule from ordinary commercial designs. Not only must military equipment be simple and easily kept in repair, but it must possess certain characteristics not generally necessary in all-around commercial work. For instance, all the devices must be designed with reference to standing heavy shocks from gunfire as well as a degree of moisture at times not commonly found in general practice. The apparatus must, too, be designed so as to stand long periods of infrequent service without getting out of adjustment or condition. Men are, of course, available to work apparatus at all times, but it is only now and then that any particular part of the equipment will be in constant active service for practice. It has many times, therefore, happened that first-class commercial devices have failed in military service, not because they have not had proper care or are not intelligently handled, but because they are not adapted to the particular kind of intermittent use and the particular set of unfavorable conditions found in the necessities of the service.

Two of the most interesting applications of electricity, those to range-finding and submarine mining, Lieut. Bender

is obviously not at liberty to describe in anything except the most casual fashion. Suffice it to say that both these matters have been worked out in the most thorough and ingenious way and both have been brought to a very much higher stage of efficiency than the general public would readily believe. The application of electric motors in the service of the heavy guns forms one of the most important additions to the resources of the artillery. Ammunition hoists and the like are now very freely used in shore batteries, as they are in the navy, and add much to the rapidity with which a gun can be served. The motor drive for gun pointing, as Lieut. Bender points out, has been not altogether a success. It would seem that much more could be done in this particular line than has yet been attempted. It ought, in fact, to be possible so to equip a 12-in. gun with electric pointing mechanism that it could actually be maneuvered with almost the facility of a one-pounder pointed with a shoulder-piece. Here is a chance for the inventor with a practical knowledge of gun pointing to do good service for the development of coast defense. The searchlight, perhaps the most important application of electricity to the service, is fortunately one of the most thoroughly developed. Experience has shown through many years the increasing importance of the searchlight, and the present 60-in. lamps installed in the large fortifications are models of convenience and efficiency. Nothing but thick weather seems able to put them out of business, and in thick weather hostile vessels are naturally cautious in trying unmarked and probably mined channels in the face of shore fortifications.

---

### THE NEW CLEVELAND GENERATING STATION.

The new Lake Shore generating station of the Cleveland Electric Illuminating Company, described on other pages of this issue, is chiefly notable as an excellent example of the sturdy character of modern central-station engineering. There are no startling or highly novel features in design, but the plant is typical of good practice and the wisdom of anticipating future business. The chosen site combines a number of natural advantages, including the cheap delivery of fuel and abundant room for fuel storage. The coal and ash-handling equipment seems to be thoroughly worked out for economical operation, and so arranged that fuel consumption can be kept under close observation.

One is most impressed, perhaps, with the careful and somewhat elaborate arrangements for obtaining an uninterrupted supply of circulating water for the surface condensers. The provision of a long intake canal extending out into the lake insures obtaining the coolest available water and precludes the possibility of troubles from ice ridges which form on a lee shore during severe winter storms. The generating equipment emphasizes the tendency to subdivide the total capacity into as few units as possible. Of course, the extremely large size of unit now in service, 20,000 kw, is not here employed and would hardly be expected. In all respects the generating equipment is substantially standard and designed for highly efficient operation. This station is so situated as a whole that the cost of energy at the switchboard ought to be unusually low. The influence of this particular choice of site upon the final cost of distributed and delivered energy is another matter, and, like most cases of the kind, it was probably a compromise.

It has long been a tradition in alternating-current distribution that all the conductors of a single supply circuit, when placed in conduit, should be incased in the same sheath or metallic envelope. The obvious reason for this apparently necessary practice is to prevent harmful and wasteful secondary currents in the metal envelope. But of late there has been some tendency to depart from this orthodox practice, in certain instances. In the present case it was not practicable to employ three-conductor, lead-covered cables for the main generator circuits to the switch-house except by connecting a number of them in parallel for each machine. Instead it was decided to use single-conductor, fiber-cored, cambric-insulated cables, carried in fiber ducts. Thus it was possible to avoid multiple cables and also, through a departure from the lead-sheath type of mechanical protection, to avoid the possibility of damage to the cable sheaths from local secondary currents. This practice is apparently feasible, in the case of cables carrying heavy currents, where the proper types of cable and duct are employed; and so far as it adds to the machine reactance without exceeding the amount necessary for adequate protection, it appears to be commendable practice.

---

### IMPORTATION OF A VERY LARGE GENERATING UNIT.

The announcement in the *Electrical World* last week that the Commonwealth Edison Company of Chicago has placed an order with an English manufacturer for a 25,000-kw horizontal turbo-generator to be installed in the Fisk Street station is of rather exceptional interest. It comes from an operating company which by its bold engineering has contributed materially to advancement in the design of electric generating stations and substations and urban transmission and distribution systems. Heretofore the turbine-driven generating units used in the power houses of the Commonwealth Edison Company have been of the vertical type, so that this change to a horizontal machine marks a departure in practice. No doubt the reason for this is the remarkable economy which the horizontal types of generating units have shown in some of the more recent English generating stations, particularly in the region around Newcastle-on-Tyne. Furthermore, the turbine is of a type which cannot be obtained in this country, and it will be built under the direct supervision of Sir Charles A. Parsons, who is probably the leading authority of the world on steam-turbine engineering.

According to the present plant, the new unit will be one of four of similar design, and to accommodate these machines a large extension will be made to the Fisk Street station. This extension will be characterized by several ingenious engineering adaptations. The new units will be 75 ft. long and 18 ft. wide, but by placing them side by side two of them will take up no more floor area than vertical turbo-generators of equal size, which would be spaced say on 44-ft. centers. However, it will be necessary to place the auxiliary machinery in the basement instead of on the floor of the turbine-room, as is the present practice in the Fisk Street station. The turbine will be especially designed

for this installation and will possess several new features relating particularly to the location of the condenser and the admission of steam to it. As has become the recent standard practice, the generator will be wound for half the line voltage, that is, 4500 volts, the line voltage being 9000 volts, with auto-transformers in circuit with the leads and serving also as reactance coils.

Of course, the extension to the station will make a greatly increased demand on the boiler-room for steam, but by an ingenious reconstruction of boilers, the use of larger boiler units and putting the economizers over the boilers in the path of the hot gases to the stack, it is declared that no greater ground area will be required for the additional steam-raising equipment, although about twice as much steam will be produced. Furthermore, all auxiliaries will be of the rotary type rather than the reciprocating type, and entire reliance will be placed on electric drive for auxiliaries. The engineers in charge of the work are not prepared at this time to go into details, but with the economies hoped for by the use of the new turbine and in the rearrangement of the other features of the extension to the power house it is expected, no doubt, that a kilowatt-hour will be produced in this new extension to the Fisk Street station at least as cheaply as in any other steam-driven electric-power plant in the world. The work involves a number of departures from existing practice, and its progress will be watched with much interest by engineers and central-station managers. It is worthy of note that the Commonwealth Edison Company, with its alert, enterprising and far-seeing management, is apparently adding another chapter to the record of American central-station practice.

---

### PROPERTIES OF DIELECTRICS IN ALTERNATING FIELDS.

The electrical properties of a pure dielectric, such as the interstellar ether, seem to be far simpler than those of imperfect dielectrics of matter, such as mica or hard rubber, and different kinds of material dielectrics behave very differently. In an article by Mr. G. L. Addenbrooke, recently published in *The Electrician* (London) and referred to in this week's *Digest,* some of the power-dissipating properties of dielectrics are studied from the experimental standpoint, with reference to varying frequencies of alternating imposed potential gradient. It is pointed out that there are two essentially different kinds of dielectrics, namely, good dielectrics and so-called "liquid dielectrics." In good dielectrics the power loss is directly proportional to the frequency and vanishes substantially at zero frequency, or for direct-current pressures; whereas in the poor dielectrics the power loss for a given potential gradient is almost independent of the frequency and is very appreciable at zero frequency. In the general case both of these characteristics are apt to be mingled in certain proportions. The whole subject is still in obscurity and is more or less connected with the phenomenon of electric conduction, itself a standing enigma. Nevertheless, the avenue of conjecture is always open until demonstration closes its gates. It seems that the corona power loss in air is proportional to the frequency of the dielectric stress, and that corona loss is a dynamic phenomenon depending upon ionization by impact. If this be admitted, then the suggestion rises that in a "good" dielectric, whether solid, liquid or gaseous, when the power dissipated is proportional to the frequency, the action is dynamic and of the corona type; whereas in poor dielectrics a certain amount of electrolysis may be assumed to occur with a power loss known to be nearly constant. On this hypothesis all dielectric conduction loss might be a superposition of electrolytic, dynamic and hysteretic losses.

---

### ELECTRICITY IN ASTRONOMICAL RESEARCH WORK.

Last week the *Electrical World* gave an account of the applications of electricity in the research work of the Mount Wilson Solar Observatory of the Carnegie Institution, in southern California, one of the most advanced outposts of astronomical science. The matter presented illustrates the importance of electricity in a field far removed from common knowledge, and yet one of great fascination to the student of celestial physics and chemistry. With the commercial impetus entirely eliminated, it is significant that electric power, illumination and heating are none the less vital factors in successful research among the phenomena of the heavens than in the acutely competitive fields of modern industry. The great observatories of the world are leaning more and more heavily upon electricity as the demands upon them increase. As customers of central-station service they are too few and far between to warrant extended consideration from such a point of view, and yet it is noteworthy that such institutions are turning to the commercial power and lighting companies here and there from economical reasons. The business is small, but it is often of the long-hour type, and the connected load is usually several times the peak; and beyond this it is of great value to the electrical art on account of the necessity which it imposes for the development of refined and specialized apparatus requiring unusual skill in design and manufacture and setting bench marks from which many new achievements in mechanism may be reckoned.

The applications of electricity at Mount Wilson include a varied service both in the observatory and laboratory, about sixty motors having a combined rating of not far from 115 hp being in use. It is noteworthy that the two largest telescopes in the world, both 60-in. reflectors, at Mount Wilson and at Cambridge, Mass., are electrically controlled, although the observatory at Harvard College has the distinction of first installing a complete electric drive with automatic electric governing service during the observing period. The great range of electrical service is striking, from the control of a telescope mass of about 22 tons to the finest adjustment of spectographic focal lengths. It is what might be expected, perhaps, but beyond this the use of electricity in duplicating astronomical observations in the electric furnace, spark and high-powered magnetic field opens up a new field for scientific research in connection with the composition and characteristics of the heavenly bodies. Hand in hand, the works of the observers on the mountain and in the laboratory at its base go forward in advancement of scientific progress, and at every step electrical methods are saving time and money, while pointing the way toward still deeper penetrations of the hitherto inscrutable universe.

## TRANSPORTATION TO SEATTLE N. E. L. A. CONVENTION.

The transportation committee of the National Electric Light Association has completed the details for the movement of delegates, members and others to the annual convention to be held at Seattle, Wash., from June 10 to 14. Mr. Charles H. Hodskinson, as chairman of the committee, has issued a transportation circular which is a complete and comprehensive summary of different tours, rates, etc., and contains full information and instructions for the guidance of those desiring to be present at that meeting.

SPECIAL TOURS.

Arrangements have been completed for four special tours, designated as Tours A, B, C and D, which will be run over different routes as follows:

Tour A is called the "Tour de Luxe," and from the standpoint of scenic grandeur in the different places visited will surpass anything ever attempted in the way of a special tour, not even excepting the famous "bankers' special," about which so much has been said and written. The train will be one of the most luxurious ever sent over any railroad in this country.

The cost of this tour will be based on the "all expense plan," being inclusive of railroad and sleeping-car fares, meals and side trips described in the itinerary, but it does not include the expenses of the stay in Seattle during the convention. There will be two trains leaving on May 26, one from Boston and the other from New York, over the New York Central Railroad, and visiting the Grand Canyon of Arizona, Riverside, Pasadena, Los Angeles, Santa Barbara, Del Monte, San Francisco (thence by the Shasta route to Seattle), Portland, Yellowstone National Park, Salt Lake City, Glenwood Springs, Colorado Rockies, Colorado Springs and Denver. The New York train will be known as the "Red Special" and will be under the personal direction of Mr. G. W. Elliott, 239 West Thirty-ninth Street, New York. The Boston train, to be known as the "Blue Special," will be in charge of Mr. Charles B. Burleigh, 84 State Street, Boston.

Tour B will cover only the outgoing trip. A train, to be known as the "Pink Special," will leave New York City over the Pennsylvania Railroad on June 3, visiting en route Banff Hot Springs and Lake Louise, proceeding through the Canadian Rockies to the Glaciers, and Fraser Canyon to Vancouver, thence by steamer to Victoria and to Seattle. This train will be in charge of Mr. J. C. McQuiston, 165 Broadway, New York. A second train to visit the same points of interest, to be known as the "Green Special," will leave the Grand Central Station, Chicago, on June 4. It will be under the direction of Mr. G. A. Freeman, 120 West Adams Street, Chicago. This tour will be conducted on the "all expense" plan and it also will be an outgoing trip only.

Tour C covers only the going trip and is not to be run on the "all expense" plan. A train to be known as the "Orange Special" will leave the Union Passenger Station, Chicago, on June 6. Mr. G. A. Freeman will have charge of the arrangements for this train, which will travel over the Chicago, Milwaukee & St. Paul Railway and the Chicago, Milwaukee and Puget Sound Railway.

Tour D will be covered by a train to be known as the "Purple Special," in charge of Mr. H. Sphoehrer, Twelfth and Locust Streets, St. Louis. It will leave Union Station, St. Louis, and travel over the Wabash Railroad, the Chicago, Burlington & Quincy Railroad and the Great Northern Railway. Like Tours B and C, this tour will be a going trip only.

Round-trip tickets for all trips will be sold from May 27 to June 6, and will be honored for return to original starting point up to July 27. Reduced rates will be allowed only on round-trip tickets.

## The Government and the Aluminum Interest.

According to advices from Washington the Attorney-General has practically agreed with representatives of the aluminum manufacturing interest on a decree in a case which will later be brought before a federal court. After several weeks of conferences between the Department of Justice and George B. Gordon, Esq., general counsel for the aluminum interest, it is stated that an agreement has been reached which will obviate a contest in the courts. The decree, it is believed, will not provide for a dissolution of the corporation, but for injunctions against certain of its contractual relations. If no hitch develops, the suit will be filed against the company at Pittsburgh, and as soon as the parties to it make their appearance in court the agreed decree will be entered.

## Opening of the Cambridge Subway.

The Boston Elevated Railway Company opened the Cambridge subway for service on the morning of March 23, and the running time between Harvard Square and Park Street, Boston, was cut from twenty-five minutes to eight minutes. The subway was built by the company, the Boston connection being built by the Boston Transit Commission. It is one of the most efficient transit lines in the world, consisting of about 3.2 miles of double-track line operated on the 600-volt direct-current, third-rail system, with multiple-unit trains composed of cars about 70 ft. long and costing $12,000 each. It is estimated that the subway will save seventeen days of ten hours each to every passenger who uses it for a year at morning and night. The subway equipped cost about $11,750,000, and was built in two and three-quarter years, or about a year under the legally specified time. Central-station energy was largely used in the work of construction.

## MINNESOTA SECTION, A. I. E. E.

A convention of the Minnesota Section of the American Institute of Electrical Engineers was held at Minneapolis, March 18 and 19, in connection with the electrical exhibition in progress during the same week. On Monday afternoon Mr. M. R. Hutchinson, of Orange, N. J., presented an illustrated discussion of the Edison nickel-iron storage battery, and Mr. A. L. Abbott, of St. Paul, read a paper on the work of the illuminating engineer, outlining the principles along which modern illumination work is being developed. Tuesday afternoon Mr. W. D'A. Ryan, of Schenectady, N. Y., spoke on the subject of "Lighting from the Early Ages to the Present Time," his remarks being illustrated by lantern slides showing modern installations of street and spectacular illumination. Mr. W. R. Patton, St. Louis, Mo., followed with a paper on the unity power-factor motor, comparing the economy of single-phase with other forms of distribution. "Station Graphical Records" was the title of a paper by Mr. E. H. Schofield, chief engineer of the Twin City Rapid Transit Company, describing the elaborate system of curves used for plant and operating records. The evening meeting followed a dinner at the Hotel Radisson, with Mr. Ralph W. Pope, honorary secretary of the Institute, as the guest of the Minnesota Section. Dean Francis C. Shenehon, of the University of Minnesota, discussed the diversion of water from Niagara Falls for power purposes to the injury of its scenic beauty, urging that the efficiency of the present developments be increased and that further diversion be postponed until a future time of real exhaustion of other resources. Secretary Pope suggested the possibility of magnetically testing steel rails to guard against invisible flaws which lead to disastrous wrecks. Mr. Tru-

man Hibbard, Minneapolis, spoke on engineering education, and Mr. F. A. Otto, St. Paul, gave results of tests of the new flame-arc street lighting in that city. Other speakers who closed the evening's program with impromptu addresses were Prof. W. T. Ryan, Prof. W. Cavanaugh, Mr. Edward P. Burch and Mr. F. G. Dustin. Mr. Charles L. Pillsbury, Minneapolis, presided as chairman of the sessions.

## STREET-LIGHTING EXTENSION WITH FLAME-ARC LAMPS IN CHICAGO.

Work is proceeding steadily on the preparations for the added 10,000 arc lamps for street lighting in Chicago, which, with the necessary substations, transmission and distributing circuits, posts, lamps, etc., the Sanitary District is under contract to furnish to the city. The competition for furnishing the lamps has been settled in favor of the General Electric Company, a contract having been entered into by which that company is to supply 4000 inclosed series alternating-current flame-arc lamps. The specifications provide that the lamps must be of the flame type and adapted to be connected in series to a maximum of 100. All lamps must be adjusted for operation on a current of 10 amp at a frequency of 60 cycles, with 60 volts at the arc. The watts consumed between the terminals of each lamp will be 460. With yellow-light electrodes the mean lower hemispherical candle-power with clear globes will be 2200, while the candle-power at 45 deg. below horizontal with clear globes will be 2500. The electrical efficiency of the lamp is given as 90 per cent, and the lamps must operate at a power-factor of not less than 78 per cent. Each lamp will be provided with automatic cut-out, adjusted to extinguish the light before the voltage of the lamp exceeds 75. The lamps will be made by the General Electric Company at Pittsfield, Mass., and the electrodes will be made by the National Carbon Company at Cleveland. The lamp is to operate from 90 to 100 hours on one trim. The cost of electrodes for ninety hours' service (for yellow-light electrodes and in lots of 150,000) will be 15 cents. Upper electrodes are 14 in. long and 0.875 in. in diameter; lower electrodes, 5.875 in. long and the same diameter. Inner globes are to be of clear glass and will cost $3.25 a dozen for renewals. The price for each lamp complete, under this contract, is $31. Five hundred lamps are to be delivered by April 15, 1912, and future deliveries as agreed upon. The General Electric Company has furnished a bond for $62,000 (50 per cent of the contract price) for the faithful performance of the work.

The accepted design of lamp-post is simple and unobtrusive, consisting mainly of slender iron piping, with a fluted base and a reinforced bracket at the top from which the lamp is suspended. The tentative height of suspension is 20 ft., although the Chicago Section of the Illuminating Engineering Society is endeavoring to have the height of suspension placed at 30 ft., both to secure greater efficiency of illumination and to protect the eyes of passers-by from the direct light of these powerful lamps.

Several new substations will be required. One of these is nearly ready for service, and bids for two others have been received lately. Of these two one will be at the corner of Byron Street and East Ravenswood Park and the other will be on West Twenty-second Street between Spaulding and Sawyer Avenues. Bids for the erection of each building, including excavation and concrete, ranged from $16,500 to $24,250. Separate bids were received for hot-water heating and plumbing. Three bids were received for the electrical equipment for both substations. They were as follows: W. F. Cummings, $36,250; Pierce Electric Company, $36,847; W. A. Jackson Company, $37,500. The bids were referred to the engineering committee for report.

## ANNUAL REPORT OF THE AMERICAN TELEPHONE & TELEGRAPH COMPANY.

The annual report of the American Telephone & Telegraph Company for the year 1911 is of interest both for the important statistics presented on the Bell industry as a whole and the extensive discussion of corporate public relations. Besides these features, it also gives the operations of the American Telephone & Telegraph Company as a separate corporation, and discusses the co-ordination of the Bell telephone service and the Western Union telegraph service.

The fiscal operations of the entire Bell system for the year, in gross amount, and as compared with 1910, were as shown in the accompanying table:

BELL TELEPHONE FISCAL STATEMENT, 1911.

| | Amount. | Per Cent Increase. |
|---|---|---|
| Total revenues | $179,477,998 | 8.4 |
| Expenses: | | |
| Operation | 60,085,425 | 10.8 |
| Maintenance | 30,184,522 | 17.2 |
| Depreciation | 28,655,832 | 9.1 |
| Taxes | 8,965,922 | 7.3 |
| Total | 127,891,701 | 11.6 |
| Net earnings | 51,586,297 | 1.1 |
| Interest | 13,610,860 | 17.8 |
| Balance | 37,975,437 | 3.7* |
| Dividends | 25,966,876 | 3.2 |
| Surplus | 12,008,561 | 15.9* |

* Decrease.

This comparison shows that, although the revenues increased 8.4 per cent, the expenses increased 11.6 per cent, reducing the increase in the net to 1.1 per cent. In regard to the increased cost of operation the report says: "This is mostly accounted for by increased operators' wages. This item will increase steadily, not only from the general causes which influence wages, but from the fact that each year the growing complexity of telephonic apparatus and equipment and the demands for improved service make greater demands on the capacity and efficiency of our employees."

The operating ratio in 1911 was 71.1 per cent, compared with 69.1 per cent in 1910. The disposition of the total revenue is given as 50 per cent for salaries and wages, 25 per cent for materials, traveling, rent and taxes, and 25 per cent for interest, dividends and surplus.

Excluding all duplications, the combined balance sheet as of Dec. 31, 1911, makes the showing reproduced herewith; the per cent of change given refers to the previous year as a basis.

BALANCE SHEET, DEC. 31, 1911.

| | Amount. | Per Cent Increase. |
|---|---|---|
| Assets: | | |
| Contracts and licenses | $2,943,381 | None |
| Telephone plant | 666,660,702 | 9.1 |
| Supplies, tools, etc. | 20,749,568 | 1.1* |
| Receivables | 32,916,127 | 26.2 |
| Cash | 41,878,140 | 52.1 |
| Stocks and bonds | 66,777,231 | 3.1 |
| Total assets | $831,925,149 | 10.5 |
| Liabilities: | | |
| Capital stock | $379,727,832 | 10.2 |
| Funded debt | 241,032,822 | 7.2 |
| Bills payable | 41,198,431 | 3.2* |
| Accounts payable | 23,382,438 | 7.6 |
| Surplus and reserves | 146,583,626 | 22.6 |
| Total liabilities | $831,925,149 | 10.5 |

* Decrease.

During the year past $58,840,000 was appropriated out of revenue for maintenance and reconstruction, a balance of over $12,000,000 remaining unexpended at the end of the year. Plant additions during the year called for $55,660,000,

and it is estimated that $56,000,000 will be needed for 1912. The existing and current resources of the company will provide about $30,000,000 of the required amount.

The Bell system has now developed to the point where its toll system reaches 70,000 places, from many of which a telegraph message also can be sent. In the point of numbers this development compares with less than 65,000 post offices, 60,000 railroad stations and 25,000 regular telegraph offices. The number of Bell exchange stations was 4,474,171, an increase over 1910 of 11 per cent, and the number of connected independent stations was 2,158,454, an increase of 16.5 per cent, making a grand total of 6,632,625 stations connected to the system. The comparatively large gain in connected independent stations is rather remarkable and reflects the increasing tendency toward general physical connection and the establishment of a great common network of interconnecting systems. Substantially one-half of the independent stations in the country are now part of this network, or three-fourths of all the stations, both Bell and independent.

The wire plant, which represents so large a proportion of the investment, contained at the end of the year 1911 a total of 12,932,615 miles of single wire, an increase of 11.1 per cent. This total was divided between 11,000,000 miles, substantially, in exchange service, and 2,000,000 in toll service. The proportion of underground wire is about 53 per cent, which includes 411,406 miles of toll wire. The important Boston-Washington subway is nearing completion, the last gap being the cable for the Providence-New Haven section. The total length of this subway will be about 450 miles, and it will contain about 2100 miles of single duct and 79,000 miles of wire in the initial cable.

The daily average traffic during 1911 was 645,000 toll connections, being an increase of 7 per cent, and 23,484,000 exchange connections, an increase of 8.3 per cent. A comparison of communication in Europe and the United States, by mail, telegraph and telephone, shows that, whereas 23.9 per cent of the total in Europe was telephonic, the large proportion of 58.7 per cent was telephonic in this country; the comparison also reveals the fact that telegraphic communication in this country is about one-fourth in volume that in Europe. At the same time the grand totals of all communications in both the United States and Europe are substantially the same, using the statistics of 1909 as a basis.

The American Telephone & Telegraph Company proper is mainly a holding or parent company for the Bell system, but it also directly owns and operates the long-distance system, owns and exercises a controlling interest in the Western Electric Company—virtually the manufacturing and supply department for the entire system—and extends financial, legal and engineering aid to its subsidiary companies.

The legal department is giving a large amount of attention to cases before the public service commissions involving rates or service. The report has this to say in reference to the company's position on rate-making principles: "In the so-called rate case the Maryland commission stated that everyone sees at once that the rule of fairness requires that every consumer should pay for his own actual use, and it is not easy to find a reason that would justify a different rule in the case of telephone service. The commission thus sustained our position in regard to measured service in large cities as against flat rates.

"The Board of Public Utility Commissioners of the State of New Jersey in the Camden rate case decided that it is not practicable at all, or would involve undue and unnecessary delay, to segregate and isolate services and cost within restricted municipal areas. The board is of the opinion that to reach a proper basis on which a reasonable return may be earned the entire property of the system of the telephone company inventoried will suffice. This decision is in line with our conception of a universal system and sustains our position that a basis of rates should not be confined to an exchange area."

The matter of commission regulation is becoming very important to the Bell interests, for the reason that in twenty-eight states such regulation, in respect to telephone rates, is now in force. The work of the central engineering department also comes in for considerable comment.

The company has continued its policy, previously announced, of consolidating its subsidiaries into larger operating units, and for that purpose is acquiring as fast as expedient the minority interest in these companies. The per cent of holdings of the whole has been increased from 70 to more than 95 by recent acquisitions. In keeping with this plan the parent concern will continue to exercise the functions of a centralized general administration and will settle all questions which relate to the system as a unit. There will be eight or ten grand divisions for operating purposes, with boundaries fixed by present commercial conditions, instead of the somewhat obsolete plan which formerly prevailed. Each division, or group of companies, will be an operating unit with a complete organization, in order to counteract the tendency toward over-concentration of authority. On the general question of organization the report contains this interesting statement:

"But the great advantage is that each division and each subdivision within wide limits is an autonomous whole; there is life and responsibility in the administration and operations of every separate division and subdivision—such life and responsibility as will carry the business along as an independent entity for almost indefinite periods under any possible conditions which may arise. With such conditions, nothing can happen which would be disastrous to the business, for whatever might happen would autonomously right itself or be righted by the concerted action of this army of individuals, or by some individual of the army, now being trained to action and to take responsibility by having responsibility put upon them."

Like its predecessors, the report deals at some length with the question of public relations and then reviews the more recent suggestion for government ownership, with particular reference to the telegraph system. It is pointed out that the ratio of the use of the mails to the telegraph is nearly 100 to 1 and less than 5 per cent of the population use the telegraph, so that while the telegraph may be a popular convenience, it has not become a necessity in the sense of universal use. Specifically the report summarizes the situation in the following statements:

"The discussion of the government ownership of the wire companies is not likely to become anything more than academic, at least for the present.

"Even if the final conclusion should favor government purchase of all wire plants, there would be no unfavorable consequences to the shareholders of the wire companies other than the obligatory liquidation."

The report treats the Western Union telegraph situation with unusual frankness and brings out several fundamental questions not heretofore discussed. The Western Union system has been built up to its present development under the closest possible relations with the steam railroads, extending back over many years. Thousands of telegraph offices are situated in railroad ticket offices and waiting-rooms, and a large proportion of the wire plant is on railroad right-of-way. While this policy of development may once have constituted an element of strength, it undoubtedly hampers the service to-day in more senses than one. In taking up the subject the report says:

"The Western Union has over 25,000 offices in over 21,000 places, and in addition many thousand agency offices at the toll stations of the Bell system. From less than 2000 of the 21,000 places, with an aggregate population of about 40,000,000, over 90 per cent of its entire revenue is obtained. Nearly 17,000 of the 21,000 places have an average revenue of but slightly above $10 a month with a maximum of $50 a month. Some joint operating arrangement, generally with the railroad telegraph service, has been made for these and

many other places where the revenue is insufficient to maintain an exclusive Western Union office. The increasing demand of the railroad telegraph service upon its operators, and because their first duty is to the railroad service, places the commercial telegraph service in a secondary place, which, with the best of intentions, is not conducive either to promptness or efficiency."

The report continues with a discussion of the obvious economies which will result from consolidating the telephone and telegraph wire plants, and comes to the conclusion that by this means a reduction in the gross revenues of from 20 per cent to 25 per cent without affecting the profits of the business is within the realm of possibilities. At the same time it is pointed out that prudence dictates postponing certain of the physical changes in the plants until the preliminary work of arranging the proper business relationships is satisfactorily settled.

The unit costs of construction and operation are of considerable statistical interest, and the accompanying tabular comparison contains the principal items from a larger table in the report. The cost unit employed in this table is exclusively the exchange station or telephone.

UNIT COSTS OF CONSTRUCTION AND OPERATION.

| | 1895. | 1900. | 1905. | 1910. | 1911. |
|---|---|---|---|---|---|
| Revenues: | | | | | |
| Exchange service | $69.75 | $44.68 | $33.31 | $31.28 | $30.85 |
| Toll service | 11.35 | 12.60 | 9.95 | 9.47 | 8.98 |
| Total | 81.10 | 57.28 | 43.26 | 40.75 | 39.83 |
| Expenses: | | | | | |
| Operation | $29.15 | $21.63 | $16.96 | $15.14 | $15.36 |
| Maintenance and depreciation | 26.20 | 17.68 | 13.91 | 13.46 | 13.41 |
| Taxes | 2.23 | 2.37 | 1.49 | 2.00 | 1.94 |
| Total | 57.58 | 41.68 | 32.36 | 30.60 | 30.71 |
| Net earnings | $23.52 | $15.60 | $10.90 | $10.15 | $9.12 |
| Per cent increase in exchange telephones | 15.7 | 26.5 | 24.5 | 11.8 | 10.8 |
| Per cent increase in miles exchange wire | 15.9 | 33.2 | 27.2 | 12.0 | 12.3 |
| Per cent increase in miles toll wire | 21.3 | 25.2 | 12.4 | 11.5 | 6.5 |
| Average cost per station (toll included) | $260 | $199 | $145 | $142 | $141 |

The slight loss in revenue per exchange station, for both exchange and toll service, reflects either reduced rates or a large development in the less expensive classes of service, probably the latter to a great degree. The total loss is $0.92 per station compared with 1910. The cost of operation rose $0.22 per station, maintenance and depreciation fell $0.05 and taxes fell $0.06, leaving an increase in the total expense of $0.11 per station. This accounts for a loss in the net equal to $1.03 per station. The average plant investment per station decreased but slightly, from $142 to $141. In fact, the whole decrease has been only $4 in the past six years.

## JOINT MEETING W. S. E. AND A. I. E. E.

Before a joint meeting of the Electrical Section of the Western Society of Engineers and the Chicago Section of the American Institute of Electrical Engineers, held in the former's rooms at Chicago, March 25, Mr. H. F. Smith, of the A. O. Smith Gas Producer Company, New Lexington, Ohio, spoke on the subject of producer-gas power. In discussing the chemical reactions which occur in the producer, the speaker pointed out the necessity for the presence of steam or water vapor, the hydrogen in which acts as a catalytic agent and is absolutely required to bring about certain supposedly simple carbon and oxygen reactions now shown to occur only when hydrogen, however minute in quantity, is present. For example, said Mr. Smith, carbon dioxide will not burn in an atmosphere of pure air or oxygen unless water vapor or hydrogen is present. Producers can be worked at grate intensities of 8 lb. of anthracite, or 16 lb. of bituminous, coal per square foot of surface per hour. In closing his address the speaker exhibited sections and photographs of practical producer installations. One located in Baltimore develops a brake hp-hour on 0.77 lb. of coal, equivalent to a kilowatt-hour at the switchboard on 1.2 lb. of coal. A producer at San Antonio, Tex., working on lignite, develops a brake hp-hour on 1.75 lb. of fuel.

## MINNESOTA ELECTRICAL ASSOCIATION.

President Ludwig Kemper, of Albert Lea, Minn., opened the fifth annual convention of the Minnesota Electrical Association, in the Minneapolis Armory, March 20 with his official address, in which he discussed present vital subjects of commission regulation, control of patented articles, the lamp situation and association matters. Mr. E. T. Street, St. Paul, followed with his report as secretary-treasurer, and Mr. George Marvin, St. Cloud, reported for the membership committee.

The technical program was opened by Mr. Earle D. Jackson, consulting engineer, St. Paul, who read a paper on internal-combustion engines, describing the properties of fuel oils and the principles of operation of low pressure and Diesel oil engines, giving unit weights, costs, etc. Comparing the high-pressure and low-pressure types, the author concluded that at full loads the latter show fuel consumptions 50 to 100 per cent higher than the high-pressure types, while their weights and costs are 30 per cent less. The low-pressure engines run at greater speeds, but for fuel oils they are practically limited to the distillates. In comparing units using different fuels, the speaker warned against dependence entirely on thermal-efficiency claims.

Mr. Leonard Peterson, Thief River Falls, said that two 225-hp Diesel engines recently installed in his plant produce 100 kw-hr. on 10.5 gal. of 39 deg. distillate, costing 6.5 cents. Mr. Guste Reed, Granite Falls, reported "no trouble" after four months of Diesel operation. Messrs. A. W. Wagner, Huron, S. D.; Alfred Horne, Fairmont, Minn., and R. E. Brown, Mankato, all testified that while an internal-combustion engine may show superior fuel economy, the trouble and worry in keeping it in service must not be overlooked.

Mr. W. D'A. Ryan, illuminating engineer for the General Electric Company, Schenectady, N. Y., next presented an illustrated lecture on artificial lighting methods of the past and present, showing views of modern street and spectacular lighting installations.

Mr. R. E. Brown's paper, "Increasing Revenue in Small Towns," related the methods used by the new-business department at Mankato. Newspaper advertising is employed to announce special appliance offers, toaster and house-wiring campaigns, etc. A recent offer to rebate 20 per cent of wiring costs (in no case exceeding $10) brought in many new customers. Mr. Brown's paper provoked a discussion of the problem of securing day load and starting up day service. Mr. Thomas Pitts, of Hutchinson, declared that domestic appliances had proved a better load than motors in his case, although neither yet equaled more than the cost of the extra labor and fuel required. Mr. W. H. Buchan, of Worthington, is urging his community to put a contemplated additional water-works investment into a motor-driven pump, which will aid in starting his day service. Mr. E. Simmons, of Marshall, said that the operation of a vacuum steam-heating system had strengthened the financial status of his plant. Mr. L. R. Runkle, of Cloquet, advised electricity for domestic cooking. Mr. E. W. Erick, of Canby, told of acquiring a profitable motor load. Mr. L. Kemper, of Albert Lea, insisted that any motor not worth a minimum of $1 per hp per month was not wanted on his lines. Mr. J. C. Bang, of Madison, said that the first year after starting day service in his town of 1800 the receipts were $2,600 and the expenses $1,800. Mr. H. Han-

son, of Ortonville, said that the coal required to give day service is really little more than that required to break and bank the fire every twenty-four hours, amounting to about 1000 lb. to 1200 lb. in either case. One year with banked fires the coal bill was $3,500, and the next, with all-day service, it was but $3,600. Mr. Alfred Horne, Fairmont, said his present day load comprises 200 irons and 346 hp in motors, with prospects for 75 hp more, including several refrigerating plants. Each house he wires is fitted with conductors for operating an electric range.

"Accounting for Small Central Stations" was the subject of a paper by Mr. C. G. Edwards, Albert Lea, which he illustrated with the office forms of the Albert Lea company. Use is made of the voucher system, on account of its accuracy and simplicity, the necessary forms being a two-column ledger, voucher register, customers' ledger, meter-

PRESIDENT-ELECT GEORGE MARVIN.

readers' book and stock ledger, besides the meter and transformer records and engineers' daily reports. Blank dial post cards for the customer to fill in are left by meter readers who fail to gain access to meters. Mr. A. H. Dickerson, Windom, thought this idea might well be extended to the reading of all meters by customers. Mr. Norman Macbeth, Bloomfield, N. J., and Mr. H. J. Gille, Minneapolis, pointed out how the postcard system, as used in Minneapolis, instils confidence and interest in the customer, besides educating him in the uses of a meter. Mr. A. A. Johnson, Wheaton, reported that he charges $1 minimum, with 15 per cent discount where the customer owns his meter. Mr. L. Peterson also charges $1 minimum, except in June, July and August, when the minimum bill is 50 cents. In addition, a monthly meter rental of 15 cents is charged at all times of the year. Mr. E. F. Strong, of Chaska, where 35 per cent of the meters are owned by customers, charges 75 cents minimum to these meter owners and $1 minimum to others. Mr. A. H. Dickerson, Windom, testified to the difficulty of collecting for repairs on privately owned meters. Mr. J. C. Bang, Madison, has found the best plan to be the repair of customers' meters free of charge. Mr. E. A. Aspnes, Montevideo, questioned whether a commission would permit the charge of meter rental in addition to a minimum. Mr. H. E. Zimmerman, Hudson, Wis., said the Wisconsin commission has permitted such a charge, provided the total sum does not exceed $1 a month.

"Gas, Gasoline, Arc and Incandescent Street Lighting," a joint paper by Messrs. William Coale, Sterling Electric Manufacturing Company, Warren, Ohio, and H. H. Magdsick, National Electric Lamp Association, Cleveland, Ohio, was presented by the latter. Comparing tungsten incandescent post lighting with other forms of illumination, the authors exhibited tables to show the superiority of tungsten economy and distribution, besides its simplicity of operation and maintenance. The paper gave figures on the cost of gas street lamps in Cleveland, $20.66 per year for both gas and maintenance, while the corresponding tungsten-unit expense, it was pointed out, is but $7.61 to $20.41 a year. Cleveland's 1200 gasoline-vapor lamps have cost $30.94 per lamp year. The paper closed with an analysis of arc and incandescent operating costs under various energy schedules. Mr. R. B. Wallace in discussing the subject presented figures, computed preliminary to the installation of flame arcs in St. Paul, tending to show that incandescent lighting might be more expensive than arc installations, and insisted that arc lamps would furnish better distribution.

"Competitive Illuminants" was the subject of Mr. Norman Macbeth's paper, in which he pleaded for the use of selling arguments based not on light flux or cost, but on *service*, when meeting gas or gasoline competition. The speaker warned against underestimating the strength of the gas forces, although he pointed out the lack of dependability of gas-burner ratings under varying drafts, pressures, gas quality, age, etc. He deplored recent tungsten-lamp advertising which suggests "the same light for one-third the cost," urging instead the slogan "Three times the light at the same cost." For no other outlay, he declared, does the purchaser receive such value as when buying illumination, and Mr. Macbeth reiterated with effect his assertion that service, not cheapness, should be the argument of the electric-lighting solicitor.

Mr. H. J. Gille declared that gas is not an active competitor in the lighting fields of most Minnesota towns, since in many of these only electricity is available. Mr. F. A. Otto, St. Paul, said that the introduction of the reflex gas mantle has been the greatest element of gas competition recently brought out. Mr. E. L. Callahan, Chicago, declared his opinion that gas has no field in illumination whatsoever and is rapidly losing even its present small hold. Mr. H. H. Magdsick said that the pilot flame of a gas arc may consume one-quarter as much as the main burners in ordinary use. Mr. R. M. Howard, Winona, also urged against talking comparative costs to customers.

On Friday afternoon Mr. S. H. Conkey, Minneapolis, read a paper on "Electric Vehicles and the Central Station," advising the company which desires to create such a charging load to maintain a conspicuous position in the use of vehicles itself. Care should be taken to show the private user that the company is interested in the successful and economical performance of his car, and that the advice of its experts is available at all times of need. In furthering local electric-vehicle interests the central station may either take an agency itself and enter into sales competition or it may assume an unpartisan position of encouragement to all cars, acting as the adviser of the customer. Assumption of either position will depend upon local conditions, but once taken up, it should be adhered to. Mr. E. T. Street, St. Paul, read figures of performance obtained in Chicago and advised central stations to do a garage business along with the stabling of their own cars.

The report of the nominating committee, presented by Mr. T. C. Gordon, Little Falls, was accepted and the following new officers were declared unanimously elected: President, George Marvin, St. Cloud; vice-presidents, L. Peterson, Thief River Falls, and W. J. Buchan, Worthington; secretary-treasurer, E. F. Strong, Chaska. Executive committee: Eugene Holcomb, St. Paul; Ludwig Kemper, Albert Lea; R. E. Brown, Mankato; George Marvin and E. F. Strong.

On motion of the retiring president, Mr. Kemper, the following resolution concerning the present situation in the sale of lamps was passed by unanimous vote: "Be it resolved, That the Minnesota Electrical Association disapproves of the present method of marketing patented electric incandescent lamps for the reason that this method discrimi-

nates in price in favor of the dealer and opens the way to certain practices in retailing these lamps which are injurious to the best interests of both the central station and its customers."

## CONVENTION OF NEW ENGLAND SECTION OF THE N. E. L. A.

The third annual convention of the New England Section of the National Electric Light Association was held in Springfield, Mass., on March 21 and 22. About 125 members and guests were present in the hotel ballroom when the meeting was called to order by President H. T. Sands, of Boston. A short business meeting preceded the reading of the first paper. President Sands addressed the gathering, welcoming those in attendance on behalf of the section and reviewing the work of the past year, especially emphasizing the establishment of the Luncheon Club branch at Boston, the increasing value of the work of the section's office and headquarters at 149 Tremont Street, Boston, the desirability of holding a fall convention during the Boston 1912 Electric Show, and the opportunities for the extension of membership. The New England Section is the largest geographical group in the association, having a present membership of about 800. The report of the secretary, Miss O. A. Bursiel, was then read. It showed a gain of sixty-seven members from Jan. 1, 1912, to the day before the convention. The Luncheon Club mailing list includes over 1800 names, this being the largest weekly gathering of electrical men in the world in the middle of a business day. The report of the treasurer, Mr. Welles E. Holmes, was then read.

Thursday afternoon's session was devoted to the reading of a paper by Mr. L. L. Elden, of the Edison Electric Illuminating Company of Boston, on "Load-Factor and Power-Factor—How to Improve Them."

### LOAD-FACTOR AND POWER-FACTOR.

Mr. Elden emphasized the importance of raising the central-station load-factor, which has improved but little above the 25 per cent average during the past ten years. Improvement may be accomplished through combination with other properties the load curves of which do not coincide and by improving the load-factors of individual customers by agreements covering special hours of operation or through improved methods of operation. The advisability of off-peak rates must be decided on its merits by each company, the success of such rates being dependent upon the nature and volume of business obtained by such systems. Refrigeration, farming applications, the recovery of oxygen and nitrogen from the air and electric irrigation furnish typical opportunities. The sales organization should be a valuable factor in the selection of the most profitable classes of service. It is desirable to keep before the solicitors the load curves of their own systems in order that they may study the low parts of the curve and search for "valley" business. Power-factor has only recently been forced upon the solicitor as a feature in making contracts with consumers.

The author pointed out the benefits of department store motor service as an off-peak load and referred to the reduction in maximum demand in a large electric garage of from 800 kw to 200 kw by the spreading of the load over a twelve-hour period instead of attempting to charge all vehicles simultaneously. Resistance losses can be reduced by charging similar batteries in groups. The load-factor in street lighting may be improved by encouraging all-night service in place of short-hour moonlight schedules. Other desirable applications of an off-peak type cited were quarrying, stonecutting, hall and church lighting, charging hot-water heaters, the lighting of summer resorts, summer sign-lighting, paper-mill service, tannery motors, railroad-signal operation, telephone exchange electrical service supply, railroad station and yard illumination, hotel, stable, garage, restaurant, drug-store, recreation-room, entrance and corridor lighting, and pumping.

A number of cases were cited by the author in which the load-factors had been improved by careful engineering. In a large razor-making plant a number of electric tempering furnaces had been installed, each requiring about 30 kw demand for one-half hour to raise the furnace to the proper temperature, after which 12 kw per furnace was continuously demanded. The cost of operation was high on account of the practice of starting all the furnaces at the same time, and the operating cost of an increased installation was too heavy to be attractive. By arranging a new schedule of operation in which the furnaces were started singly and all brought into service by 7 a. m. the result to the consumer was a most favorable rate and to the company a volume of business nearly double that formerly supplied. The new load-factor being almost 100 per cent, no additional generating or distributing equipment was required. The power-factor of the installation is 95 per cent.

In a rubber factory a trial motor installation in connection with a rearrangement of certain manufacturing processes and application of a permanent motor service upon the basis of the data secured resulted in practically a constant load. The installation comprises 1295 hp in induction motors, with an average demand of 225 kw and a maximum demand of 490 kw at 85 per cent power-factor. The load-factor is 61.5 per cent. In the plant of the Walworth Manufacturing Company, Boston, Mass., the load on each motor installation made was first tested with a trial motor. A continuous pouring system was adopted in the foundry, making the demand for the blowers continuous, with a maximum demand representing only one blower motor. The starting currents of heavy air-compressor motors were eliminated by arranging to start an idle pump by admitting always available air to the cylinders, bringing the pump and its motor to speed and then throwing the motor on the line. The installation comprises forty-three induction motors, aggregating 1129 hp, and one 95-hp synchronous motor. The average twenty-four-hour demand is 221 kw, maximum demand 720 kw load-factor 43 per cent, power-factor 83 per cent.

Taking up the question of power-factor, Mr. Elden described the evil effects of wattless output and contended that power-factor should have some recognition in rate making. The central station must still look to the motor manufacturer for improvement in equipment. The following maximum demands were recently obtained in an investigation of the load conditions of a company supplying energy to 3900 motor customers:

| Maximum Demand of Installns. in hp. | Per Cent of Connected Load. | Maximum Demand of Installns. in hp. | Per Cent of Connected Load. |
|---|---|---|---|
| 1–5 | 75 | 11–20 | 65 |
| 6–10 | 65 | Over 20 | 43 |

Mr. Elden contended that in dealing with large consumers whose apparatus develops power-factors below 80 per cent additions to the rates should be made, or else the user should provide a synchronous condenser at his own expense. Group driving of machine tools is preferable to individual driving as a means of preventing low power-factor. Transformer rearrangement offers a means of power-factor improvement in many cases.

### *Discussion.*

The paper was discussed by Messrs. Alexander Macomber, Boston; C. T. Mossman, Boston; C. A. Mixer, Rumford Falls, Maine; J. H. Wilson, Berlin, N. H.; W. H. Oviatt, Providence, R. I.; John West, Boston; Day Baker,

E. S. Mansfield and C. B. Burleigh, Boston; Welles E. Holmes, Cambridge, Mass.; C. R. Hayes, Fitchburg, Mass.; E. L. Brown, Boston; J. A. Fleet, Portland, Maine, and W. B. Schwabe, Windsor Locks, Conn. The practice of installing synchronous condensing equipment was generally favored. Mr. Mossman defended the motor manufacturer, urging that everything possible is being done by designers to improve the power-factor. He felt that the central-station man can meet the situation through rate adjustments and pointed out the value of flywheels on motor-driven machinery having heavy starting torque and fluctuating loads. Mr. Mixer remarked that the rate committee should consider the factors discussed in Mr. Elden's paper, and Mr. Wilson cited a case where the power-factor was increased from 60 to 78 per cent by installing smaller motors in an over-powered plant. Mr. Mansfield emphasized the value of the electric vehicle charging load, which seldom occurs in commercial garages until the evening lighting peak is past. The greater part of pleasure vehicle battery charging is off-peak. The load-factor should average at least 75 per cent in large commercial garages.

Mr. Burleigh said that the average rating per motor in the textile mill seven years ago was 100 hp as compared with less than 20 hp to-day, but the power-factor of such mills, which is about 80 per cent, has not been seriously reduced, because of improvements in motor design. The power-factor in the machine shop seldom exceeds 30 per cent, and the subject deserves investigation. Mr. Holmes stated that the Cambridge Electric Light Company is negotiating a contract in which a reduced rate is offered for an installation containing a 300-hp synchronous motor. The plan is to cut the load off the motor in three winter months, running it light at that time on the system. Mr. Hayes cited the practice of installing a lighting generator to be run in winter by an engine exhausting into the heating system, the generator being run as a synchronous motor during the rest of the year. Mr. Mixer cited the case of a Western company which gives a 10 per cent discount if the power-factor exceeds 90 per cent, and another instance in which the actual rate is determined by dividing a base rate at 90 per cent power-factor by the actual power-factor. The cost of putting in curve-drawing instruments was mentioned as a disadvantage in connection with small motor installations. Mr. Fleet advocated the use of large synchronous motors to offset the bad influence of small installations upon the power-factor. Mr. Schwabe said that a 125-kva synchronous motor had increased the power-factor of a certain manufacturing plant from 55 to 90 per cent and greatly improved the service. The central-station company supplied the motor. Mr. Elden closed the discussion by citing the poor results which sometimes occur when the consumer is persuaded to purchase too large motors. He favored group driving, from the power-factor point of view. In some cases it has been possible to obtain a power-factor as high as 65 per cent when using 2-hp individual motors, but in the larger plants the group drive tends to yield power-factors of from 80 to 85 per cent compared with about 50 per cent in equivalent individual drives. The overload range of the modern small motor is a valuable feature in its favor. The use of trial motors has justified the cost thus far in the practice of the Boston Edison company. One prominent manufacturer is now preparing a group of suitable motors for trial use, and in some cases the large motor-load customer has co-operated by purchasing trial motors which have been made of a size suitable for later installation in his plant.

A cabaret performance was the closing feature of the first day, the program containing many vaudeville turns with electrical stage names.

The first paper presented on Friday was one by Mr. Clifton R. Hayes, resident manager of the Fitchburg (Mass.) Gas & Electric Light Company, on "The Relation of the Central Station to the Wiring Contractor."

### RELATION OF THE CENTRAL STATION TO THE WIRING CONTRACTOR.

The author pointed out that if the central station is content to take on merely the business that comes to it it can grow only slowly. The policy must be one with initiative, with close co-operation between the contractors and the operating companies. Mr. Hayes favored leaving all construction work outside the company's own system to the contractor, keeping the electricity supply organization out of the wiring business and allowing the contractor to act as an intermediary in the process of connecting the customers' circuits to the lines. As the desire to obtain electric service precedes the necessity for electric wiring, it should bear the expense of practically all solicitation for new business. If the contractor will take on work, not at a loss, but at a small margin of profit, the larger field opened up will in itself offer greater opportunities. Mr. Hayes contended that the profit on appliances should be maintained so that the contractor will receive at least a fair return upon his sales. On the sale of motors the profit is not of much importance, but too low a price on flatirons prejudices the customer against the company. The central station should sell tungsten lamps only to its regular customers. Little will be gained by holding back the low-candle-power tungsten lamp. Electric lighting to be popular must be cheap, and it will then be used more generally with a greater net profit to the company.

*Discussion.*

The paper was vigorously discussed. Mr. E. M. Addis, Brattleboro, Vt., said that in small towns it is often necessary for the central station to support a low-price house-wiring campaign in order to secure the business. In his case the company's rates were reduced one-third and the plant equipment increased 100 per cent, and yet the business barely held its own until the company started a house-wiring campaign, installing complete equipment in cottages for from $20 to $30 each. A premium of $1.50 was given to each employee securing a thirty-dollar contract and a smaller premium for each lower-priced installation. One line foreman received $21 in premiums for this work, and the company added 140 residences to its connected load in 1911 without spending over $100 in the way of equipment extensions. Mr. E. P. Rowell, Plymouth, Mass., cited the advantages of backing up the contractors to a certain extent financially in encouraging low-cost installation.

Mr. F. L. Ball, Haverhill, Mass., emphasized the necessity of specializing in order to obtain new business, as in house-wiring campaigns. Reflectors and other material need standardization. He cited difficulties in the way of making arrangements with a large number of contractors. Mr. A. F. Townsend, Woonsocket, R. I., favored leaving wiring to the contractors, except in rare instances. He felt that customers regard the central station more highly when the latter keeps out of the contractor's field. Where central stations do wiring the payment of bills is slower and the public expects too much.

Mr. H. G. Lendrim, president of the Providence (R. I.) Contractors' Association, in cogent terms condemned low-price wiring campaigns, with special reference to city conditions. On account of the labor conditions in cities he could not conceive of installing seven outlets complete in a cottage house for $20, with good material and workmanship. He pays journeymen $3.28 per day of eight hours and helpers $2.19, and under present conditions could not agree with those who favored low-price campaigns. The pleasant and cordial co-operative relations between the contracting and central-station interests of Providence were described. Mr. F. D. Adams, New Haven, Conn., advocated a live-and-let-live policy. Mr. Addis again took up the cudgels in defence of the small central-station wiring campaign, and said that his lighting income increased 9 per cent in 1911, and that 10 per cent was made on all the wiring done, on

the average. The contractors had been told in advance that the company was planning the campaign and were not hostile to it. It was the only way to get the business in the small town under the conditions existing. Mr. R. W. Rollins, Worcester, Mass., said that in his experience at Hartford it was generally the case that a large number of outlets were specified by the customer, the outlets above the minimum being billed at a price of $3 each, which usually brought the expense to about $50. Mr. J. P. Coghlin, a Worcester (Mass.) contractor, pointed out that the labor problem controls in large cities. Less than half the work is done to-day for the same cost by a union journeyman and helper than a good man would have turned out fifteen years ago. On many of these thirty-five-dollar wiring jobs no overhead charge is included, and often no expense except the labor is counted. The central station has no better employee than the active contractor, who draws nothing from the company payroll. Mr. W. B. Schwabe, Windsor Locks, Conn., said that the low-priced wiring campaign is absolutely essential to the customer of small means and advocated instalment methods of payment. Mr. L. D. Gibbs, Boston, contended that there is no use trying to give people something in order to stimulate electric service. The point is to see that the contractor comes out of the affair all right and to charge the deficit, if any, to the advertising account, where it belongs. Every successful wiring contractor is a salesman or employs one. Mr. Gibbs made a strong plea on behalf of getting the meters in as soon as the installation is ready for service. The gas companies are doing better than the central stations in this work. Contractors should be treated as parts of the central-station world, sheets from hint books and every possible assistance being given to them. More time spent with the contractor while an office boy at $6 a week attends to unimportant matters will pay handsomely.

The next paper was by Mr. Walter R. Eaton, of the Cambridge (Mass.) Electric Light Company, on "The Exhaust Steam Turbine as Applied to Electric Lighting."

### THE EXHAUST STEAM TURBINE.

Mr. Eaton described in detail the results of operation which have been obtained at Cambridge through the installation of a 500-kw mixed-pressure turbo-unit in connection with an 18-in. by 38-in. by 42-in. vertical cross-compound engine directly connected to a 500-kw generator. The unit as a whole was expected to give better regulation and better engine efficiency, to reduce the water bills, and, by improving the engine load-factor, to better the station efficiency. This outcome has been attained. The turbine exhausts into a surface condenser, the general piping scheme being designed so that the exhaust of the exciter and auxiliaries can be turned either into the feed-water heaters or into the engine exhaust and, when the turbine throttle is closed, into the atmosphere. In addition, for testing purposes the condenser auxiliaries have an exhaust into the condenser.

Details were given of the acceptance tests of the turbine unit and of the original engine equipment. These showed that the unit including auxiliaries consumed 17.3 lb. per kw-hr., compared with 22.2 lb. in the case of the engine, full-load operation being provided. The combined turbine and engine showed a steam consumption about 4.9 lb. less at full load than did the engine alone. The plant also contains a pair of reciprocating engine units of 1500-kw and 2000-kw rating respectively, and the steam consumption of the former unit at 787 kw output, or half-load, is 22.6 lb. per kw-hr., and that of the same unit at full-load, or 1543 kw, is 20.3 lb.

The paper also contained the results of an investigation of the cost of operation under different conditions of exhaust service, fixed charges being included. Exhausting to the atmosphere cost 19 cents per hour, exhausting to the condenser 15.25 cents, and exhausting to the heaters and separators 6.33 cents each. The winter's log of the station shows a saving of 10 per cent in coal consumption per kw-hr. over last winter, a portion of the saving being attributable to the installation of stokers under some of the boilers and the rest largely to the installation of the exhaust turbine set. During a week's run without the turbine the coal consumption per kw-hr. increased 6 per cent.

*Discussion.*

Mr. Eugene Carpenter, Oak Bluffs, Mass., cited an investigation at Colorado Springs which showed that the best over-all efficiency is obtained by the use of a compound condensing engine and a low-pressure turbine. He described the features of a new plant to be built for central-station service in the Vineyard Sound district under his direction. Efforts are to be made to corral every possible heat unit by the plan of passing the flue gases through a superheater which will take the discharged steam from an engine low-pressure cylinder, the latter then being passed through a feed-water heater into a low-pressure turbine and condenser equipment. The plant will be equipped with Taylor stokers and the air used in the boiler furnaces will be drawn from the top of the engine-room in order to take advantage of the heat there available.

Mr. Edward L. Clark, Westinghouse Machine Company, Boston, condemned the preservation of old low-pressure engines and stated the ease of operation possible when using a low-pressure turbine in multiple with an engine unit. He touched upon the value of the low-pressure turbine in carrying heavy loads by overexciting the turbo-generator. In case of a break-down the mixed-pressure equipment is useful when available for service on reduced pressure from a boiler line. The specific steam-consumption curve of the engine and turbine combination is flatter than that of the engine alone, and this is an advantage in carrying varying loads. No economy attaches to the low-pressure unit unless the vacuum which can be obtained is over 25 in. The question of moisture is vital, since for every per cent of moisture in the steam specific consumption of the turbine increases 2 per cent.

Prof. H. E. Clifford, Harvard University, touched upon the drawbacks of operating induction generators by low-pressure turbines, there being a tendency for the machine to refuse to deliver energy and run away in case of a short-circuit. Mr. C. T. Mossman, Boston, said that the high-pressure turbine unit usually occupies the minimum space and costs the least for a given output. In closing, Mr. Eaton said that at Cambridge both generators are excited by a steam-driven unit.

### MEETING OF LUNCHEON CLUB SECTION.

At noon the regular Friday gathering of the Luncheon Club branch of the New England Section was held in the hotel, 290 persons being present. Chairman Gibbs announced that for ten successive weeks an average of 300 electrical men have been meeting on Fridays at the American House, Boston. Queries have been received as to the ultimate object of these meetings. Mr. Gibbs said that absolutely no interest controls these luncheons other than that of the co-operative benefit of those who attend. The speaker of the meeting at Springfield was Mr. W. H. Blood, Jr., of Stone & Webster, Boston, his subject being "The Great Northwest." About 150 lantern slides were shown of the scenic and industrial features of the Puget Sound and Alaska country, including all the larger electrical installations and systems now in service. The lecture was received with great interest and accomplished much in the way of stimulating the desire of those at the gathering to attend the forthcoming convention of the N. E. L. A. at Seattle in the early summer.

The closing business session on Friday afternoon was occupied with the reading and discussion of a paper by Mr. Fred H. Smith, superintendent of the Worcester (Mass.)

Electric Light Company, on "The Development of Electric Vehicles in New England."

ELECTRIC VEHICLES IN NEW ENGLAND.

The author deprecated the absence of co-operation which until very recently has held back the development of the electric vehicle and emphasized the need of trained supervision in securing successful operation. The recent volume of sales was cited, especially in the way of repeat orders. It is estimated that by 1915 half a billion dollars will be invested in these machines. The profits of the immediate future are based upon the fact that the manufacturers are now selling electric-vehicle service rather than the mere vehicle itself. Figures were cited showing the reliability of electric vehicle transportation, and the author pointed out the superior qualities of such service in snowy weather as compared with the frequent stalling of gasoline machines. He touched upon the Boston Edison Company's hundred-thousand-dollar advertising campaign on behalf of the electric vehicle, and said that nine out of twelve companies to which inquiries were sent in New England are giving the subject enthusiastic attention. He closed with a series of inquiries regarding the best methods of development.

*Discussion.*

Mr. J. T. Day, Malden, Mass., stated that the Malden Electric Company now has six vehicles of the electric type in service. The cost of operation of one outfit which replaced three horses was 12 cents per mile. A modern electric vehicle purchased last summer has made 6000 miles at a cost of 5 cents per mile and replaces two horses, being used twenty-four hours daily. He recommended the establishment of garages by central stations. Mr. J. A. Fleet, Portland, Maine, contended that in his case there is room for improvement in the ability of a small equipment to cope with snow. Mr. H. F. Thomson, Massachusetts Institute of Technology, Boston, emphasized the importance of service. He described briefly the research work being conducted at the Institute upon electric vehicles, and pointed out the necessity of reducing the amount of standing time in securing economical operation. Mr. Day Baker, Boston, cited the striking snow records of well-designed electric machines during the past winter and touched upon the enormous increase of business which the electric-vehicle industry is trying to handle. A great field exists for the operation of such machines in city water, fire and sewer departments.

President W. H. Blood, Jr., of the Electric Vehicle Association of America, emphasized the live qualities of that two-year-old organization and said that more than one manufacturer had testified in forcible words how much his business has been increased by the publicity given to the electric vehicle within the past year or so. Nearly $50,000 has already been raised for the 1912 advertising campaign of the association. Absolute neutrality on the part of the central station toward different makers is the price of safe and continued growth.

Chief W. H. Daggett of the Springfield Fire Department then described the electric ladder trucks and hose wagons in that city, which are making literally a world record as to economy and reliability of operation. The department is fast becoming a horseless one. Said Mr. Daggett: "The electric ladder truck put into service a year ago so far hasn't had a single skip or a sign of hesitation, and has not been out of service fifteen seconds since we owned it!" He remarked that the same thing could be said of the hose wagon. Springfield will soon operate five pieces of fire apparatus by electricity.

FIRE DEPARTMENT DEMONSTRATION OF ELECTRIC-VEHICLE SERVICE.

Through the initiative of President Day Baker, of the Boston Electric Vehicle Club, and the courtesy of Chief Daggett, a still alarm was turned in from the hotel at the close of the above discussion, and before all the members and guests had time to reach the sidewalk two electric ladder trucks and the hose wagon came flying up the street at high speed, the apparatus coming to a stop immediately in front of the hotel, where it was thoroughly inspected by a large crowd of interested central-station men. Assistant Chief Kimball stated that scarcely a day passes when Springfield is not visited by some one from a remote part of the country interested in this pioneer installation of electric vehicles in fire department service. These electric vehicles have been fully described in previous issues of the *Electrical World*.

At the close of the afternoon many members and guests availed themselves of an opportunity to inspect the magnificent new offices of the United Electric Light Company, on State Street, Springfield, near the municipal group of buildings. A description of these offices will be printed in a later issue.

BANQUET.

The convention closed with a banquet in the hotel in the evening. At the conclusion of the repast, Mr. L. R. Wallis, Boston, presented the report of the rate committee, which advised getting rid of all special rates as fast as possible and which recommended making street-lighting contracts on the basis of the Boston system of rates, which takes account of the fixed cost per lamp per year, the running cost per lamp per hour and the life of the contract, a discount being given for every year which it is to run. Thirty-one out of the thirty-five municipalities now served by the Boston company are supplied with energy on the basis of ten-year lighting contracts. A flat-rate charge per lamp per year is inadvisable.

The guests at the banquet included President John F. Gilchrist, of the National Electric Light Association; Vice-president Frank M. Tait and Secretary T. Commerford Martin. President Gilchrist spoke of the duty of the central station in rendering a public service, of the relations between employer and employee, relations with the general public outside the customers, relations between central stations and the public authorities and between central stations and kindred industries. He emphasized the right of the public to an opinion concerning the conduct of affairs, the benefits of permitting employees to share in the prosperity of their companies, the civic pride evidenced in the erection of such an office building as that in Springfield, and the co-operation possible with contractors, manufacturers and jobbers. Finally the relations between different central stations in the association itself were considered, and the value of company and geographical sections in dealing with detailed problems pointed out. The work of the Boston Luncheon Club section was commended, and a high tribute was paid to Mr. C. H. Hodskinson and the transportation committee for their work in connection with the plans for the Seattle convention.

Mr. Tait spoke in terms of praise of the work of the New England Section, and Secretary Martin spoke in a happy vein of the growth of the N. E. L. A., the possibilities of its reaching a total membership of 50,000 in the next five years and the desirability of the 3500 remaining central stations becoming parts of the organization.

The following officers will direct the affairs of the New England Section for the ensuing year: President, Mr. J. S. Whitaker, Portsmouth, N. H.; vice-president, Mr. A. B. Lisle, Providence, R. I.; treasurer, Mr. Welles E. Holmes, Cambridge, Mass.; secretary, Miss O. A. Bursiel, 149 Tremont Street, Boston, Mass. Executive committee: Messrs. L. D. Gibbs, Boston; George S. Haley, Rutland, Vt.; T. J. Chase, Concord, N. H.; F. D. Adams, New Haven, Conn.; A. F. Townsend, Woonsocket, R. I.; J. A. Fleet, Portland, Maine. Mr. W. L. Mulligan, Springfield, Mass., was chairman of the committee on entertainment at the Springfield convention, the program being in charge of Mr. Allen Foster, Boston.

## MONOCHROMATIC LIGHT AND VISUAL ACUITY.

A paper on "The Influence of the Spectral Character of Light on Effectiveness of Illumination" was presented before the Chicago Section of the Illuminating Engineering Society on March 21 by Mr. M. Luckiesh, assistant physicist of the National Electric Lamp Association. The paper was a résumé of former work done on this subject, with an account of some original investigations by the author. Much of it was devoted to optics, and the speaker explained the chromatic aberration of the eye. He said that monochromatic light seems to be the best for visual acuity or detailed revealing power. However, monochromatic light distorts color values, and therefore the practical value of monochromatic-light sources is limited by this consideration. Perhaps the value of visual acuity in practical life has been rather overrated. In photometry the acuity method may give wrong results where we are simply concerned with brightness. In many cases the usual photometric methods are more just than acuity methods. Furthermore, the latter methods do not allow for eye fatigue.

Mr. R. F. Schuchardt, chairman of the section, who presided, agreed with the speaker that acuity methods are open to criticism, and Mr. J. R. Cravath was also of the opinion that the acuity method of photometry, as practised in the laboratory, is not always to be accepted as a guide in engineering practice. Mr. George C. Keech made the interesting announcement that experiments are now under way having for their object the production of a commercial illuminant that will bring out practically all the colors of the spectrum and have an efficiency of about 1 watt per candle. He promised to lay the results of these experiments before the society at a later date. Mr. T. H. Aldrich, Dr. M. G. Lloyd and others took part in a discussion which related largely to Mr. Luckiesh's blackboard demonstration of his laboratory experiments.

## DEFEAT OF MUNICIPAL OWNERSHIP AT SOUTH FRAMINGHAM, MASS.

An important and broadly significant victory over the municipal ownership propaganda was won by the Edison Electric Illuminating Company of Boston on March 19 in the town of South Framingham, Mass., one of the outlying communities in the western portion of its system. For the past six years municipal ownership ideas have been agitated in the town, which has a population of about 6000 persons, and the Selectmen have constantly refused during that period to make a contract for street and public lighting for a term of over one year, the matter coming up yearly at the regular town meetings. As a result of the unwillingness of the town to enter into a long-term contract the taxpayers have lost about $6,000 in street-lighting discounts during the last half decade.

Two years ago a committee of five was appointed to investigate the possibilities of a municipal plant for the street and public building lighting service. The committee made an elaborate report showing the supposed costs of service in a large number of municipal plants in Massachusetts and elsewhere, and a year ago an article was incorporated in a warrant to see if the town would vote to establish a municipal plant. The matter was submitted to Australian ballot, and apparently little interest was shown, the vote being small. By a comfortable majority the municipal ownership plans were defeated. The committee and its adherents then went to the Legislature and endeavored without success to have the municipal ownership statute changed so that only a majority vote would be required to establish the municipal system. Under the existing law a two-thirds vote must be secured before municipal ownership can be adopted, and at two successive elections held at intervals not less than three months nor more than two years apart.

After the defeat of the project a year ago at an adjourned session of the annual town meeting the committee was continued and authorized to make a further investigation. The second report was submitted to the town meeting on March 12, 1912. The committee urged that the favorable vote desired was required only as a test of the sentiment of the people, no previous favorable vote having been given.

At the meeting on March 19 a total of 913 votes was cast, 608 votes being necessary for the indorsement of the municipal propaganda for the first time. The vote stood 403 yeas and 510 nays. The committee was immediately discharged by a unanimous vote, and the Selectmen were unanimously authorized to enter into a ten-year lighting contract with the Edison company. It is noteworthy that within the past few months, in spite of the agitation in South Framingham prior to the final disposition of the matter, the Selectmen of the neighboring towns of Shelburne, Holliston and Medway have signed ten-year lighting contracts with the company.

## Enactment of Public Utility Law in California.

The new public utilities act in the State of California became effective on March 23. This act was passed by the Legislature in extraordinary session during December last and provides for the regulation of all corporations and persons engaged in the so-called public utilities. Broad powers are conferred upon the railroad commission, under which it has authority to fix rates, regulate service, equipment and extensions and supervise the issue of stocks, bonds and other securities. No public utility has the right to sell its property, to engage in mergers or consolidations or to issue new securities without first obtaining the consent of the commission. The new law provides, however, that incorporated cities and towns shall retain the powers over all public utilities which they now enjoy, unless they choose to transfer them to the commission.

## PUBLIC SERVICE COMMISSION NEWS.

### NEW YORK COMMISSION.

The Public Service Commission for the First District has ordered an inquiry, to begin March 29, into the question of the service pressure furnished by the gas companies supplying Manhattan and the Bronx. In the Stevens law, which reduced the price of gas in these boroughs to 80 cents per 1000 cu. ft., there was a clause providing for the maintenance of a certain pressure by the gas companies. The United States Supreme Court, in its decision upholding the 80-cent rate, declared the pressure clause unconstitutional. Thereupon the Public Service Commission, which is empowered by law to deal with the question, began an investigation of pressure conditions and employed Mr. W. A. Baehr, a gas engineer, to conduct the investigation. Mr. Baehr has completed his work and has made a report to the commission. This report will be used at the public hearings in the forthcoming inquiry, which will be held to determine what orders, if any, shall be issued to regulate the pressure. Commissioner Milo R. Maltbie will preside at the inquiry. The commission has received in the last few years several complaints as to pressure, some of them holding that the pressure was excessive and others complaining that the pressure was too weak. It is expected that the inquiry will develop what cause exists for such complaints and will enable the commission to apply the remedy, if any is needed, by proper orders.

The commission has issued an order to the Interborough Rapid Transit Company, which operates the New York subway, to install an emergency lighting system in all cars

operated in the subway. In emergencies due to accidents or other causes the current is sometimes suddenly shut off and this leaves the trains in darkness. The emergency system will furnish a certain number of lamps in each car which will be supplied with current independently of the third-rail, either by storage battery or other device, and will be so adjusted that when the ordinary lamps go out the emergency lamps will automatically come into service at once. In case of accident the sudden darkness into which the cars are plunged in the subway aggravates the fright of the passengers, but with an emergency lighting system such a panic factor will be made impossible. The order also requires the company to provide uniform illumination at stations, sufficient for reading purposes, on all platforms, and to put tungsten or other metallic-filament lamps in all cars.

The Public Service Commission for the Second District has made an order requiring the Buffalo & Lake Erie Traction Company to install an additional feeder line extending from its substation at Athol Springs to the Blackwell Canal on the Hamburg Pike, the cables to be connected to the feeder system between the Ridge Road and Hamburg. Sufficient power supply is required after the feeder system is completed to light, heat and operate properly all cars which run to and from the terminus in Hamburg village at a rate of speed to be approved by the commission. The installation is to be completed on or before Aug. 1, 1912. The company is also required to install at Hamburg facilities for turning its cars at that point, and after the facilities are installed the company will be required to turn cars at that point and also at its terminus in the city of Buffalo.

The order was made following the complaint of Samuel Fleischmann, of Hamburg, upon which hearings were had and an inspection of the company's system was made by representatives of the commission. In addition to the order made by the commission, the company has accepted and is complying with recommendations made by the commission's inspector as to the installation of switches between Ridge Road and Hamburg, stopping all cars at certain points between Buffalo and Hamburg, cutting out twenty-four stops previously made, putting in a schedule on its Hamburg line based on a material reduction in running time between Hamburg and Buffalo, the installation of brakes, requiring conductors to announce passenger stops and requiring the motormen and conductors to exchange signals at points on single-track portions of the Hamburg division.

The commission has authorized the Union Springs Light & Power Company to exercise franchises granted by the village of Union Springs, Cayuga County, giving permission to maintain an electric light plant in that village.

On March 8 the commission for the Second District issued a sweeping order requiring all electrical corporations and municipalities owning poles and wires on public or private rights-of-way to stencil and number their poles and structures in accordance with detailed instructions set forth in the order. The order affects all central-station, telephone, telegraph, railway and municipal corporations. The stencil must exhibit the corporate initials, name or symbol and a number which will distinguish the location. The preferable method of stenciling is with paint, but metal tags, badges or stamps are admissible. In the case of a double line of poles, supporting overhead trolley wires, only one line need be stenciled. When the pole line is a through or trunk line, stencils are only required on every fifth pole except in cities, towns or villages. Every corporation is required to file with the commission before May 1, 1912, a statement of the form of stencil which it has adopted and the method of numbering used. The work of stenciling must be completed by Jan. 1, 1913.

### OHIO COMMISSION.

A petition has been filed with the Ohio commission by the Sandusky Telephone Company, of Sandusky, and the Vickery Telephone Company, of Vickery, both independent companies, asking for permission to make physical connection between their plants and operate a joint toll line. It is stated that they cover the same territory and further extension of lines by each would result in needless duplication. They also ask for approval of a new schedule of toll charges, which is practically the same as formerly, except for a few rates to new points.

### WISCONSIN COMMISSION.

The Wisconsin commission recently issued an order requiring the Milwaukee Northern Railway Company to improve its interurban service on certain sections of its line between Milwaukee and Fond du Lac. The complaint alleged that the service rendered by the defendant company between the village of Mequon and the city of Milwaukee was inadequate and discriminatory, and that the increase in fares, which took place about two years ago, was not warranted. An analysis of the earnings and operating expenses for the year ended June 30, 1911, showed that, notwithstanding the increase in passenger earnings, the net rate of return was only 2.48 per cent upon the cost of reproduction. The commission considered that the cost of reproduction was the proper value to use in computing the rate of return, for the reason that the company was entitled to an allowance for going value and working capital in addition to its present value. The present value of the property was determined to be $1,852,623 and the cost of reproduction $2,098,000 as of June 30, 1911. Depreciation was computed upon the 2 per cent sinking fund basis. The low rate of return did not warrant any reduction in fares.

The engineering staff made an extensive investigation of the service rendered by the defendant company during the month of August, 1911. The results of this investigation showed that the service was inadequate, especially during certain days of the week when the cars often ran far behind their schedules. At these times also the cars were overloaded to such an extent that they often carried from 70 per cent to 100 per cent more passengers than the rated capacity. In devising means to relieve the situation the engineering department decided that the operation of cars in multiple unit trains would not be feasible, but that the traffic should be taken care of by increasing the number of cars in operation. Upon the recommendation of the engineering staff, the commission ordered the Milwaukee Northern Company to double-track certain specified sections of its system; to increase and extend its siding facilities; to purchase additional cars of the city type for local service, and to offer twenty-minute local service in lieu of the hourly and half-hourly local service now in effect. The order must be complied with before June 1, 1912. After the respondent has taken the necessary steps to improve the service complained of, the commission will cause a second investigation to be made to determine the adequacy and efficiency of the service then rendered.

## Current News and Notes

Boston Electrification Plans.—On March 5 the committee on railroads of the Massachusetts Legislature concluded hearings upon several bills providing for the electrification of steam railroads in the Boston district. Chairman J. F. Jackson, of the Massachusetts Railroad Commission, urged the passage of a mandatory act as an initial step toward abolishing the steam locomotive in the Boston district. The prospects of electrification are at present somewhat retarded by the absence of favorable action at the last session upon the proposition to permit the New Haven company to build a tunnel between the North and South stations at Boston, which carried with it an agreement to electrify the suburban lines between Readville on the south and Beverly on the north.

City Electrical Engineer for Los Angeles.—The Public Welfare Committee of Los Angeles has approved the recommendation of the Fire Commission that the position of superintendent of the Bureau of Fire Alarm and Police Telegraph be abolished and that the new position of city electrical engineer be created, the salary to be $3,000 a year.

* * *

Street Lighting in Denver.—Electric street lighting in Denver cost $169,867 in 1911. The estimate for the present year is $180,660, which would provide for 2478 arcs at $60 a year and 1110 50-cp incandescent lamps at $28 a year as well as the lighting of the Welcome Arch. The latter has 1294 4-cp lamps, and it is maintained at $900 a year. The Denver Gas & Electric Light Company has the contract for the city lighting.

* * *

Prompt Denial of Exaggerated Reports of Damage to Keokuk Dam.—Newspaper reports under date of March 24 represented that high water had caused a fissure of considerable proportions in the "main protection of the construction" for the dam of the Mississippi River Power Company in the Mississippi River at Keokuk, Ia.; also that "an ice gorge broke, sweeping away a power house." Authoritative advices from Keokuk on March 25 are to the effect that the newspaper reports are greatly exaggerated; that the loss to that date did not exceed $50; that work is proceeding as usual, and that no further damage is expected.

* * *

Ontario Hydro-Electric Commission Bill.—A bill introduced in the Ontario House to amend the power commission act confers very broad powers on the Hydro-Electric Commission, enabling it to take over existing power-transmission lines, improve water-powers, regulate the installation of electrical equipment and wiring, control municipal rates for electrical energy or the rates of any distributing company taking energy from the commission, prescribe uniform accounting for energy-taking municipalities, order wires under its jurisdiction placed underground, and appropriate the local distributing plants of municipalities which have contracted with the commission for energy.

* * *

Reconstruction of Hatfield Dam.—The cities of La Crosse, Wis., and Winona, Minn., expect to receive hydro-electric energy within five weeks from the Hatfield (Wis.) plant of the La Crosse Water Power Company, whose Dells and Hatfield reservoirs were destroyed last October by a flood in the Black River which carried away the earth walls of the concrete structures. The Hatfield dam is being reconstructed in the form of concrete piling carrying both a Tainter gate spillway and the tracks of the Green Bay & Western Railroad. The break dynamited in the power-canal bank will be repaired as soon as the ground thaws, and operation will be resumed as before, using, however, only the lower reservoir for water storage for the present.

* * *

Diesel Engines in Oceangoing Vessels.—The *Selandia*, which was built in Denmark for the East Asiatic Company, is the largest vessel yet built equipped with Diesel engines. The length is 370 ft. and the beam is 53 ft. The propelling machinery consists of two sets of 4-cycle Diesel motors, each with eight cylinders 20.8 in. by 28.7 in., developing 2500 hp at 140 r.p.m. Two auxiliary Diesel engines, each having four cylinders and developing 250 hp at 230 r.p.m., are used for driving air compressors and two electric generators. Energy at 220 volts is used for driving all auxiliary apparatus, pumps, stearing gear, refrigerating machines, the capstan, all winches on deck, etc. For lighting purposes the energy is stepped down to 110 volts. One vessel duplicating the *Selandia* in every respect is now approaching completion, a third is under construction, and two slightly larger ones have been ordered by the same company.

* * *

Louisville Central Stations and Electrical Contractors at Loggerheads.—The competition for new business between the Louisville Lighting Company and the Kentucky Electric Company, both of which have stations at Louisville, Ky., has become so keen as to affect also the electrical contractors of the city. The Louisville Electrical Contractors' Association has made strong efforts to secure the consent of both companies to a plan permitting the sale of lamps to remain in the hands of the dealers, or to some form of agreement whereby prices will be maintained. The plan embraces besides lamps, electric fans, heating apparatus, etc. The contractors have taken the ground that the general public now has sufficient knowledge and appreciation of the various electrical devices to enable them to be handled by contractors in the regular way. Thus far complete agreement between the lighting companies and the contractors has not been effected.

* * *

Milwaukee Electrical League.—The recently organized Milwaukee Electrical League has about 150 members on its roll. The membership is limited to those interested professionally and commercially in the electrical industry in Milwaukee and vicinity, including electrical engineers, manufacturers and dealers, electrical contractors, employees of the electric-service companies and others. The objects of this society are to promote good fellowship and to further the interests of the electrical industry in Milwaukee and vicinity, also to aid in the civic advancement of the community. The officers are as follows: President, Mr. F. A. Vaughn, electrical engineer; first vice-president, Mr. S. B. Way, The Milwaukee Electric Railway & Light Company; second vice-president, Mr. Arthur Polacheck, Charles Polacheck & Brother; treasurer, Mr. George F. Rohn, electrical contractor; secretary, Mr. L. L. Tatum, Cutler-Hammer Manufacturing Company; assistant secretary, Mr. J. C. Schmidtbauer, Julius Andrae & Sons Company. It is proposed to have semi-monthly luncheons, with an address by a speaker provided by the program committee, of which Mr. C. N. Duffy is chairman.

* * *

Another Reduction of Rates in St. Louis.—Another reduction in the maximum kilowatt-hour rate from 11 cents to 10 cents, to take effect May 1, has been announced by Mr. A. C. Einstein, general manager of the Union Electric Light & Power Company, of St. Louis. With an additional discount of 5 per cent for prompt payment, the actual maximum rate will be 9.5 cents, which meets the rate as "regulated" by the Public Service Commission of St. Louis, although the Circuit Court has decided that this rate was not in accordance with law as not complying with the language of the statute. The secondary rate for residence customers is 6 cents for all consumption over 4 kw-hr. a month for each of the first four active rooms and 2.5 kw-hr. for each additional room counted. As three bedrooms are not counted, the owner of an eight-room house will pay 10 cents a kw-hr. for the first 4 kw-hr. used in four of the rooms and 10 cents for the first 2.5 kw-hr. used in the fifth room, but will get all excess consumption at 6 cents a kw-hr. Thus, after he has used 18.5 kw-hr. at 10 cents, amounting to $1.85, the consumer will get the excess consumption at 6 cents a kw-hr. Less than a year ago the company reduced the maximum rate from 12 cents to 11 cents. Mr. Einstein also announces a substantial reduction in the price of tungsten lamps beginning May 1. The minimum meter charge of $1 a month will be retained. It is expected that some time next year the company will obtain about 20,000 kw from the electrical plant of the Mississippi River Power Company at Keokuk.

North Dakota Public Utilities Association.—Arrangements are being made by Mr. W. H. Brown, of the Red River Power Company, Grand Forks, N. D., to organize the North Dakota Public Utilities Association among the thirty-seven central-station companies now operating in that State.

* * *

Irrigation Electric Plant.—Mr. W. M. Daugherty, of Artesia, N. M., is promoting a producer-gas-engine-driven electric power station to transmit energy over a rich artesian territory about Artesia, 30 by 10 miles, for irrigation by pumping. This method saves the large seepage in long ditches and has proved highly successful in placing water on otherwise dry lands. Land in alfalfa is worth $150 to $200 per acre, and in orchards from $500 to $1,000. It is proposed to supply water by metered electric pumps, to cost approximately $1.50 to $2.50 per acre-foot, the usual amount necessary for a season's irrigation.

* * *

Philadelphia Electric Company Section, N. E. L. A.—The general meeting of the Philadelphia Electric Company Section of the National Electric Light Association was held March 18 and drew an attendance of 450. The speaker was Mr. J. J. Carty, chief engineer of the American Telegraph, Telephone & Cable Company, whose topic was "Philadelphia and the Development of the Telephone Art." The underground system between Washington and Boston was described as well as the manner in which the circuits are used for telephone and telegraph work. Mr. Carty also explained the phantom circuit in an interesting manner. The Meter Department Branch met on March 1 and discussed two original papers, one by Mr. H. C. Albrecht on voltage regulation and the other by Mr. N. E. Funk on the relations and calculations of voltages in two-phase, three-wire systems. Mr. R. A. Heubner presented a paper on costs as the basis of efficiency before the Accounting Department Branch on March 12, and the Commercial Department meeting, which was held on March 25, was addressed by Mr. A. C. F. Keleher, of the Holophane Company. Mr. Keleher gave a helpful talk on salesmanship.

* * *

Illuminating Engineers' Activity in Civic Affairs.—The committee of the Chicago Section of the Illuminating Engineering Society appointed to confer with the city authorities in relation to the suspension of several thousand new flaming-arc lamps to be installed for street lighting in Chicago has been actively at work under the direction of Mr. J. R. Cravath, the chairman, and Mr. T. H. Aldrich, the vice-chairman. Both to secure illuminating efficiency and to promote the eye-comfort of users of the streets, the illuminating engineers recommend that the powerful new lamps be suspended at a height of 30 ft. above the street. The plan tentatively adopted by the city electrician calls for a suspension of 20 ft., the objection to the greater height being the increased expense for lamp standards and practical difficulties in the matter of trimming the lamps. The committee has conferred with the Mayor and the city electrician, and it has also presented a formal protest against the 20-ft. suspension in a communication to the City Council, which has been referred to the committee on gas, oil and electric light. The 20-ft. suspension has not been absolutely determined upon, although it was favored by the city authorities for the reasons mentioned above. The subject has also been taken up by the illuminating engineers' committee with the Chicago Association of Commerce, which has promised to investigate it.

* * *

## SOCIETY MEETINGS.

Arkansas Association of Public Utility Operators.—The annual meeting of the Arkansas Association Public Utility Operators will be held at Little Rock, May 20-22. Mr. W. J. Tharp, Little Rock, is secretary.

Indiana Electric Light Association.—The 1912 convention of the Indiana Electric Light Association will be held at Indianapolis Oct. 16. Mr. J. V. Zartman, 120 South Meridian Street, Indianapolis, is secretary of the association.

* * *

Sons of Jove at Minneapolis.—A class of eighty-eight novitiates was admitted into the Sons of Jove at Minneapolis March 21, the initiation exercises being held under the direction of Statesmen W. H. Vilett and J. M. Hannaford. Following the rejuvenation in the armory a Dutch lunch was served.

* * *

St. Paul Section, N. E. L. A.—At a meeting of the St. Paul Gas Light Company Section of the National Electric Light Association Monday, March 18, Mr. M. Reese Hutchinson, of Orange, N. J., gave a talk on the Edison storage battery. Mr. M. A. Pocock is president of the local section, and Mr. W. C. Beckjord is secretary.

* * *

Meeting New York Companies' Section, N. E. L. A.—The next regular meeting of the New York Companies' Section of the National Electric Light Association will be held in the Edison Auditorium April 15. Two illustrated lectures are scheduled for presentation, one by Mr. Frederick Monsen on "The Panama Canal" and the other by Mr. Augustus Post on "Navigation of the Air." Section officers will be also elected at the meeting.

* * *

Southwestern Electrical & Gas Association.—Local arrangements for the annual convention of the S. E. & G. A., to be held at San Antonio, Tex., on April 25, 26 and 27, will be in charge of Mr. W. B. Tuttle, vice-president and general manager of the San Antonio Gas & Electric Company. In connection with the convention will be held an electrical show which promises to be the most important exhibition of its kind ever held in Texas or the Southwest.

* * *

New York Electrical Society.—At a meeting of the New York Electrical Society held on March 28 Dr. William Benham Snow delivered a lecture on "The Uses of Electricity in Medicine and Surgery in Accordance with Modern Standards." At the April meeting of the society Mr. William Marconi, who was recently appointed a life senator by the Italian government for his work in wireless telegraphy, will address the society on the latest developments in wireless telegraphy. The meeting will be held in the main auditorium of the Engineering Societies Building, New York.

* * *

Chicago Meetings of Illuminating Engineering Society.—At the meeting of the Chicago Section of the Illuminating Engineering Society on March 21, after an address by Mr. M. Luckiesh, of Cleveland, Chairman Schuchardt announced subjects for succeeding meetings as follows: April 18, show-window lighting; May 16, office lighting. The paper at the May meeting will be read by Mr. F. E. Church, of Sears, Roebuck & Company. The meeting will be held at the extensive establishment of that company on the West Side, the office lighting of which will be inspected. The June meeting will be a "ladies' night" and will be semi-social in character, the subject being school-room lighting. Inasmuch as this subject is of interest to the mothers as well as the fathers of school children, the wives of members will be invited to be present and take part in the discussion if they wish. The section expressed itself in favor of Niagara Falls as the place of this year's convention of the society, or some other suitable summer resort free from the outside distractions of a large city.

# LAKE SHORE STATION OF CLEVELAND ELECTRIC ILLUMINATING COMPANY.

## 14,000-kw and 9000-kw Turbine Units—Special Arrangement of Condenser Circulation, Intake from Lake Erie, Etc.—1,250,000-Circ. Mil Cambric-Covered Cables Conveying Electric Energy to Switch-House.

AT the intersection of Seventieth Street and the shore of Lake Erie, three miles northeast of the civic center of Cleveland, the Cleveland Electric Illuminating Company has just completed the erection of its handsome new Lake Shore steam-turbine station. Planned with an ultimate capacity for twelve units, the first half of the building is now erected and already has in operation two 14,000-kw and one 9000-kw turbine set, while one 9000-kw unit is in course of erection. Adjoining the turbine-room, which skirts the water's edge, is the boiler building, while at a distance of 500 ft. and elevated on the shore bluff is located the switch-house, into which are fed the various generator leads and from which radiate the transmission trunk feeders to the local substation system.

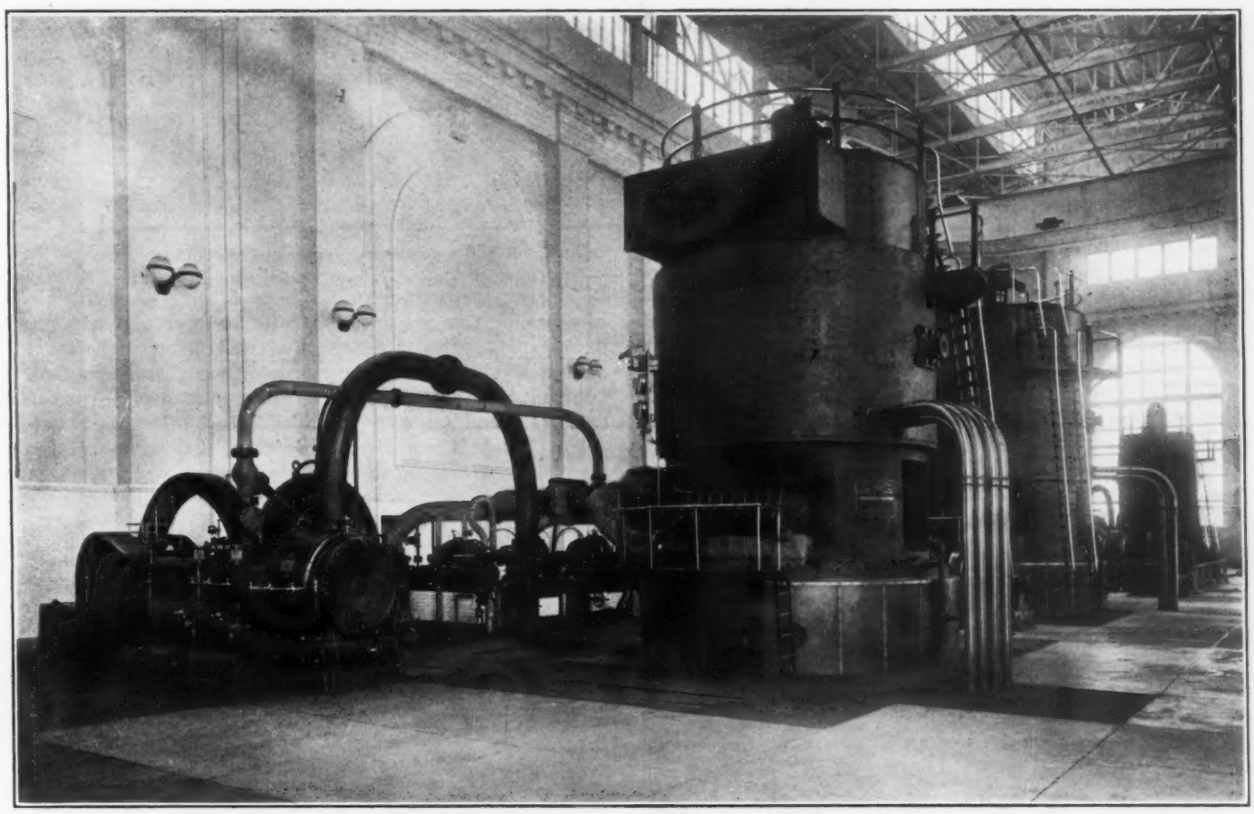


Fig. 1—14,000-kw and 9000-kw Turbo-Generator Units in Lake Shore Station of Cleveland Electric Illuminating Company.

The building of the new Lake Shore station is a monumental steel-frame structure with red-brick walls trimmed with artificial granite. In floor plan the present completed turbine and boiler rooms measure roughly 300 ft. by 275 ft. over all, while the first completed pair of the six steel stacks are 18 ft. 6 in. in inside diameter and rise to a height of 270 ft. above the basement floor. The plant property includes lake-front yardage more than 10 acres in area, having a shore front of approximately 750 ft. A large part of this yard is available for coal storage. The site adjoins the main line tracks of the Lake Shore & Michigan Southern Railway, from which the plant is easily seen.

### COAL-HANDLING AND STEAM-GENERATING EQUIPMENT.

Coal to be delivered to the plant is brought in by drop-bottom cars and run over track scales to the sheltered track hopper built into the hillside of the upper bluff level. This receiving hopper discharges through a crusher onto a belt conveyor which ascends at a grade of 10 per cent through an inclosed incline-housing to the eave level of the boiler-room. Here the coal is delivered to a transverse belt conveyor which discharges it through lateral conveyors directly into the 100-ton bunkers over the firing aisles.

The present boiler-room contains space for fifty-four boilers, providing for a row of nine 500-hp units to each turbine. These boilers are of the Stirling water-tube type with a nominal rating of 500 hp each. Eighteen have already been installed. These are fitted with Foster superheaters and Green chain-grate stokers arranged with coking grates in front. Nine other similar Stirling water-tube boilers, provided with similar superheaters and stokers, are being transferred from the Canal Street plant of the Illuminating Company to the new Lake Shore station.

The coal bunkers above the boilers are arranged with weighing hoppers, so that the fuel can be measured as fired to the furnaces. Ashes are discharged through pits opening at the basement level. Here they are loaded into ash cars propelled over narrow-gage tracks by several small direct-current locomotives, supplied with energy through 250-volt overhead trolleys. Each set of eighteen boilers is arranged with three boiler-feed pumps, one of which is a spare, serving either of the two rows of nine boilers which make up the boiler-room units. The boiler steam headers from all six rows are interconnected by a cross header so that any turbine can be operated from any set of boilers if necessary. The usual practice is to run the boiler banks in multiple, although each turbine unit may be run directly from its own battery.

### TURBINE GENERATING EQUIPMENT.

The present turbine room measures 300 ft. by 62 ft. in

floor area and 56 ft. to its roof beams. The brick walls have been lined with a white enamel wainscoting, and all steel work and plaster are painted white to conform to the impression of immaculateness given by the interior.

The first pair of turbo-alternators put into operation were

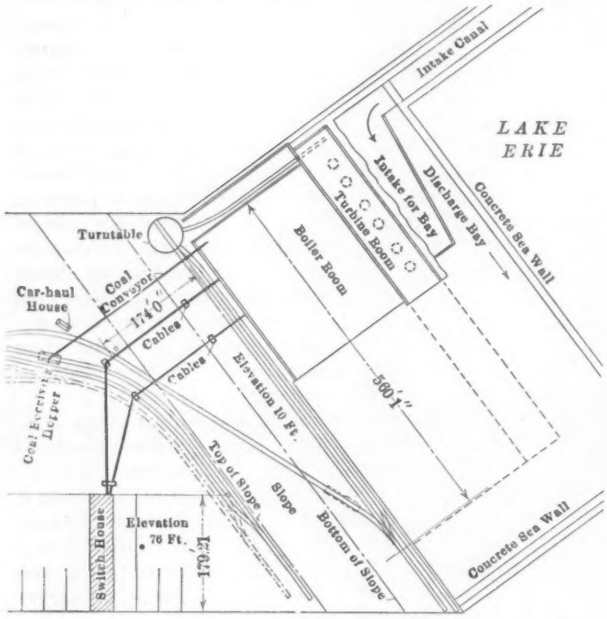



Fig. 2—Arrangement of Plant, Intake Switch House, Etc.

two 14,000-kw, 11,000-volt, three-phase, 60-cycle Curtis steam turbine sets, known as units Nos. 3 and 4, and installed near the middle of the room. Later two 9,000-kw sets of similar type were removed from the company's older Canal Street station in downtown Cleveland, and one of these is now erected as No. 1 and the other is being installed as No. 2 at the Lake Shore plant.

Each turbine is served with steam at 215-lb. pressure and 125 deg. F. superheat, from its adjoining battery of boilers, although all lines are intercepted by a crossheader for inter-operation of turbines and boilers. The 9000-kw

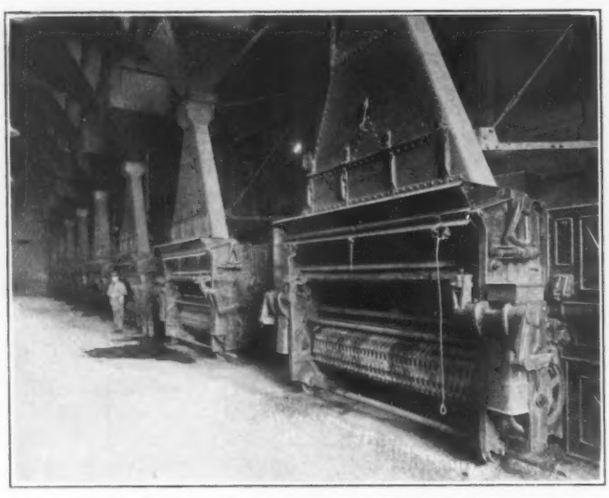


Fig. 3—Firing Aisle in Boiler-Room, Showing Weighing Hoppers and Automatic Stokers.

turbines exhaust into Wheeler base-type surface condensers, and the 14,000-kw units into Alberger condensers. These condensers are of the three-pass type.

Cooling water for the condensers is obtained through an intake canal formed by a pair of massive concrete walls which extend several hundred feet out into Lake Erie. This canal opens into the west end of the inclosed forebay which extends the length of the present and future turbine-room, diminishing in section as separated, by the oblique partition wall, from the discharge bay. The latter, increasing in width toward the east, opens into the lake at the east end of the outer sea wall. The long intake canal, extending out to open water several hundred feet from shore, insures the circulating system against interruption due to freezing of the lake.

Fig. 6 shows a typical section through one of the turbine condensers and its circulation channels. Assuming lake-

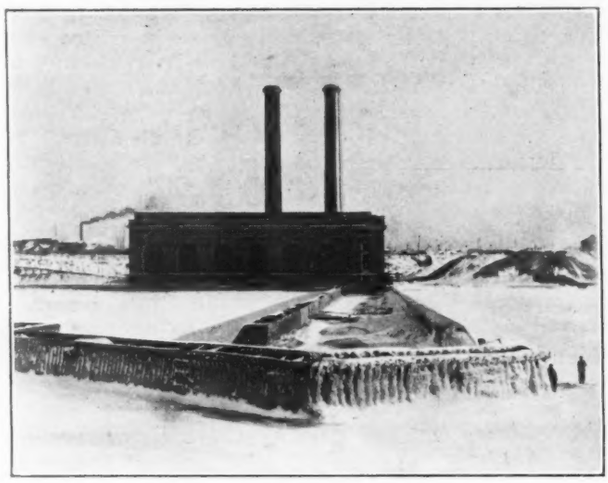


Fig. 4—Condenser Intake Canal in Winter.

level ranges from 2.5 ft. above to 6.5 ft. below Cleveland city datum, the condenser 5-ft. intake passages, which are arranged in pairs, are depressed well below any expected fall in level in the intake canal. Each pair of intakes is controlled by gates operated from common platforms outside of the building wall. Paralleling each other, the two 5-ft. tubes pass between the turbine bases and below the basement floor, diverging to open into elliptical wells 22 ft. deep measured below their concreted rims, which extend 4 ft. above the floor level. From these wells, at the rear of the

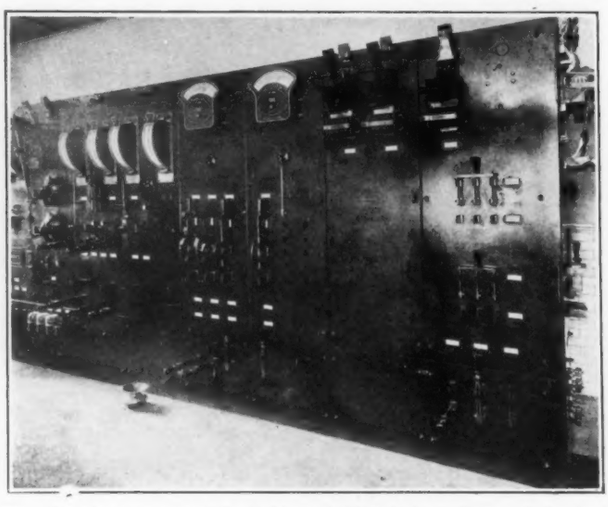


Fig. 5—Direct-Current Switchboard Situated at Rear of Central Gallery.

turbine settings, the engine-driven centrifugal circulating pumps, located on the upper or main turbine-room level, receive their supply. After traversing the condensers the discharge water is delivered into circular wells, similar to the intake reservoir already mentioned. Through inverted siphons passing under the forebay and 16 ft. below datum, these discharge wells open into the outlet bay. The ar-

rangement of intake and outlet, as shown in the plan, eliminates any mixture of warm discharge water with the cooling input, which would act to reduce the turbine efficiency.

Behind each turbine on the main operating floor is located the corresponding centrifugal pump driven by a horizontal Corliss engine, the piston rod of which also drives the reciprocating dry-vacuum pump mounted on the same base. The three turbine-driven feed-water pumps already mentioned are installed on the same floor, between adjacent circulating pumps, while flanking them are the high-pressure oil pumps. The separate accumulators for the individual step-bearing systems are located just beyond the turbine-room wall in the boiler-room. On a line midway between turbine centers are installed the exciters. These comprise one 75-kw turbine-driven and two 200-kw motor-driven 125-volt direct-current generators.

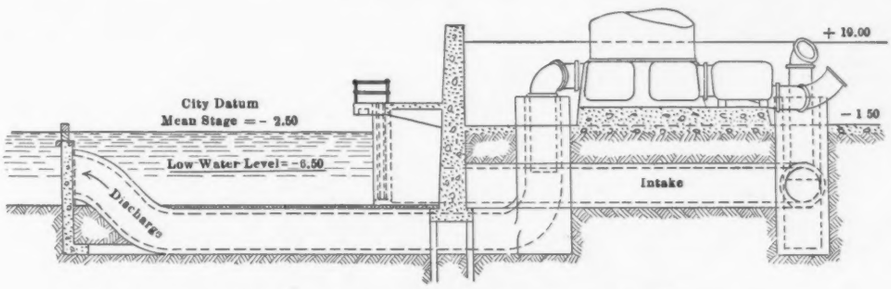



Fig. 6—Section Through Condenser Circulation System.

As already noted, the present Lake Shore station, completed for six units, comprises just one-half the building as planned entire. The east wall is thus a temporary partition, and near it, on the south turbine-room wall, is the central control gallery from which all operations of starting and synchronizing machines are performed, the principal switching operations being manipulated from the switch-house which is separate from the station building.

GENERATOR LINES TO SWITCH-HOUSE.

Cambric-covered, single-conductor 1,250,000-circ. mil cables convey the main generator circuits to the switch-house in a thoroughly water-proofed subway, shown in plan in Fig. 2. This cable had to be specially manufactured for the 500-ft. run, and its use formed the final solution of an interesting problem.

Had three-conductor lead-covered cable been used in sizes commercially or practically available, a number of parallel cables would have been required, multiplying the cost of potheads, switches, etc. On the other hand, to have run a single conductor carrying large 60-cycle current through a lead sheath would have set up a potential difference of about 40 volts in the 500-ft. distance. To insulate and thus open-circuit this sheath would have been annoying and troublesome, while to short-circuit or ground it would have resulted in objectionable heating effects in the sheath of the cable.

The final solution was, therefore, the use of single-conductor fiber-cored 1,250,000-circ. mil cambric-insulated cable, carried in fiber ducts. The copper measures 1.33 in. in diameter and is covered by 11/32 in. varnished-cambric insulation. Plastic compound tape and weatherproof braid make up the total diameter of 2.25 in. During the factory test this cable was required to stand 27,500 volts for five minutes, having an actual break-down strength of 52,000 volts.

SWITCHING EQUIPMENT AND SWITCH-HOUSE.

The control gallery at the power house contains a bench board with the necessary instruments and apparatus for controlling the generator main switches, field switches, field rheostats, governors, synchronizing devices, etc. Another board carries the reverse-current relays for the generator leads. A separate control panel is provided for the 11,000-volt solenoid-operated, single-phase neutral switches. There are two neutral buses each arranged to be connected to three machines and a ground. At the rear of the gallery is the exciter board, to which are brought all direct-current

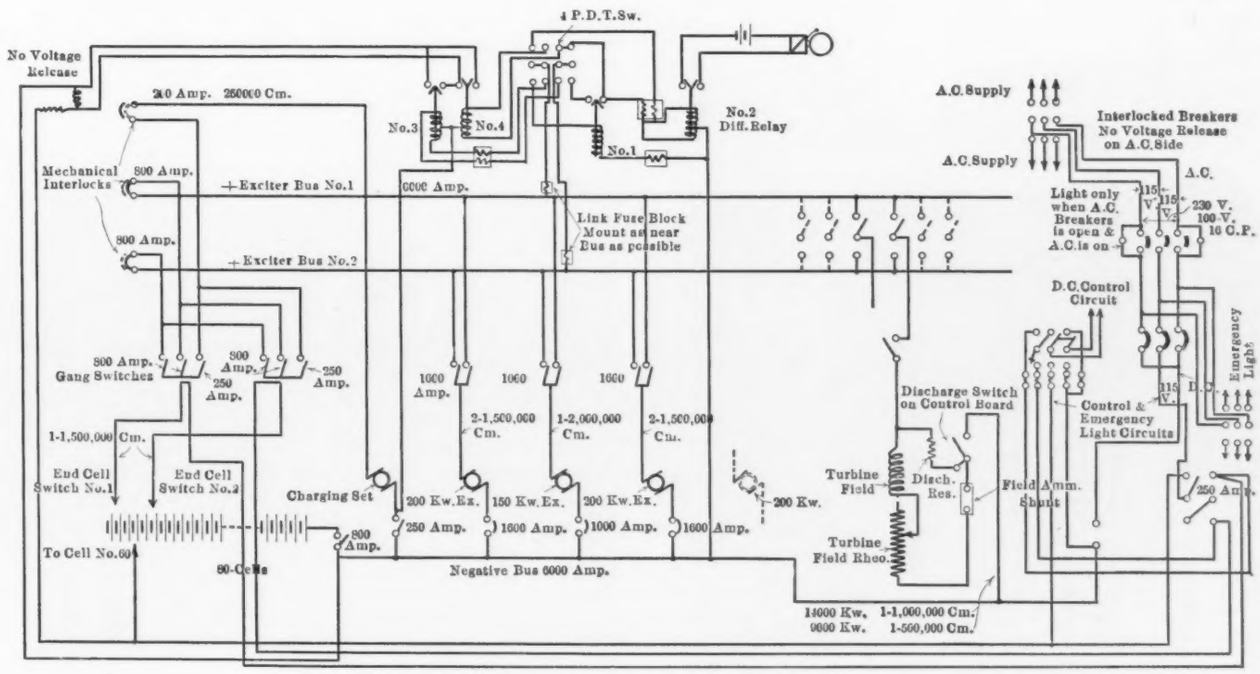



Fig. 7—Direct-Current and Exciter Bus Arrangement.

field circuits, exciter connections, battery lines, and so forth.

The auxiliary station battery comprises eighty cells with a discharge capacity of 800 amp-hr. The battery room is located in the basement of the boiler-house section, and its equipment includes two end-cell switches. This battery is

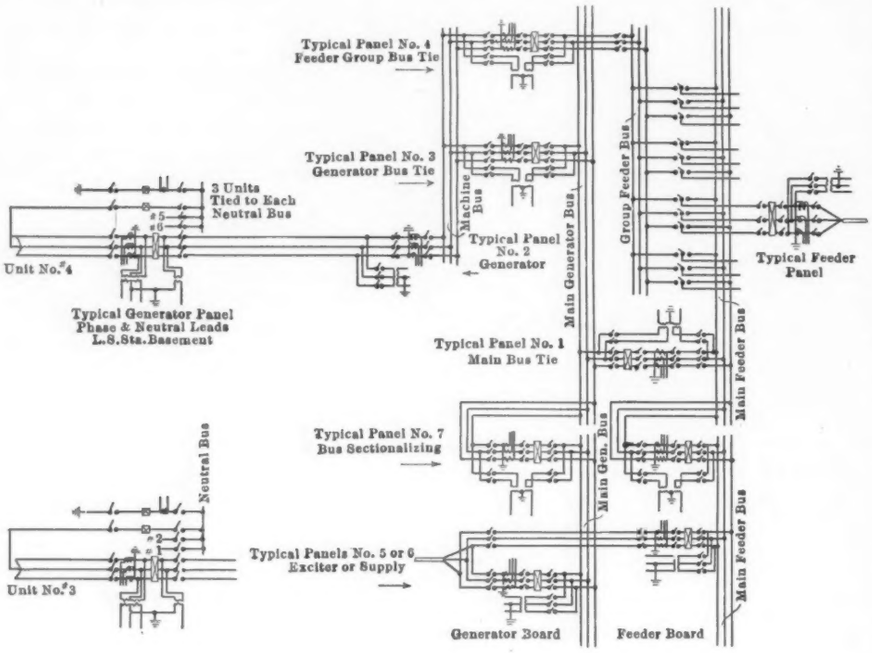



Fig. 8—High-Tension Wiring Diagram.

arranged to be charged by a special motor-generator set, having a pressure range of 80 volts to 230 volts. The main generator switches are also grouped in the basement of the boiler-room section, in a special compartment, all other

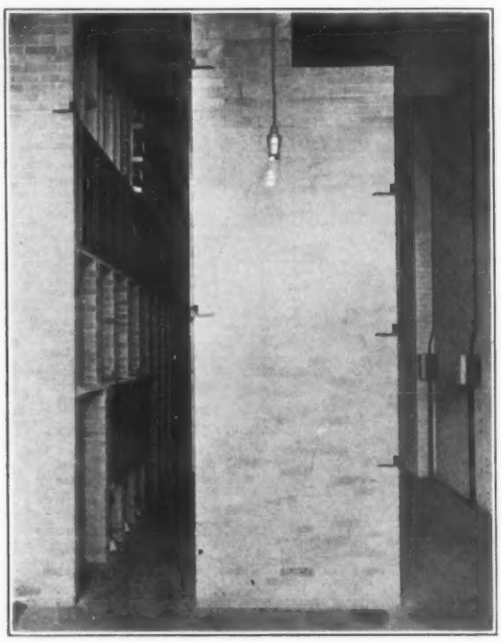


Fig. 9—High-Tension Bus Construction Below Switch-Room in Switch-House.

switches having been placed in the switch-house building.

The switch-house is a three-story and basement structure, 35 ft. by 175 ft., covering an entire building lot on Seventieth Street, on which the structure fronts. The basement contains the transformers, cableways, etc. On the first floor are located the brick bus compartments, disconnecting switches, instrument transformers, etc. The second floor is given over to the oil switches and the third carries the operating switchboards for 11,000-volt control and 2300-volt distribution. Typical sections of the bus-compartment floor are shown in an accompanying illustration, which reveals the plan of carrying the cables through the yellow-brick bus structures used on both the generator and feeder sides. The generator bus is divided into two sections, connected by tie switches, and each section is arranged to be served by three generating units. The plan of switching connections is illustrated in Fig. 8.

Mr. Samuel Scovil is vice-president and treasurer of the Cleveland Electric Illuminating Company, and Mr. Robert Lindsay is general manager.

The plans for the new Lake Shore station were prepared under the direction of and the construction of the station supervised by the company's own engineering staff, Messrs. J. W. Carpenter, field engineer; P. L. Cobb, mechanical engineer; John Wolff, steam superintendent; H. L. Wallau, electrical engineer; F. S. Lewis, electrical superintendent, and C. F. Izant, architect, with Mr. Frederick Sargent, of Sargent & Lundy, as consulting engineer.

## HYDRAULIC REGRADE OF PORTLAND (ORE.) WITH MOTOR-DRIVEN PUMPS.

Motor-driven pumps supplying hydraulic giants were first used in the extensive regrade operations about Seattle, Wash., several years ago, as described in these columns. Later, on the completion of the Seattle work, the same pumps were removed to Portland, Ore., where a gravelly prominence known as Goldsmith's Hill has been removed by washing it through a sluice into Guild's Lake. A total of nearly 3,000,000 cu. ft. of material has been handled in this way, some of the rocks and boulders transported measuring nearly a foot in diameter. Cuts as deep as 140 ft. have been effected, the hill being converted into a series of terraces which will carry trees and lawns. After the lower gravels have been removed, rich soil from the upper level is flushed over the denuded areas.

The pumping outfit used has comprised two Westinghouse 650-hp, 2200-volt, 60-cycle, two-phase motors, each direct-connected to a pair of Worthington five-stage pumps capable of delivering 500,000 gal. of water per hour at pressures of 200 lb. to 300 lb. per sq. in. There is also a booster unit comprising a 900-hp motor driving a volute pump. Energy to operate the motors is obtained from the lines of the Portland Railway & Light Company.

Two 18-in. wire-wound wooden-stave pipe lines carry the water at 200-lb. pressure from the pump-house at the lake-side to the hill 3000 ft. distant. Hydraulic-giant nozzles 2 in. to 4.5 in. in diameter are employed here, the vertical face of the hill being first undercut and the loose piles of material then washed away through an open sluice built on trestlework beneath the water lines. The settling of this material in Guild's Lake has reclaimed several acres for real-estate purposes. After clearing, the same water is then pumped back through the nozzles to transport more material.

# THE UTILIZATION OF ELECTRICITY IN UNITED STATES COAST DEFENSE.

## Its Generation, Distribution and Applications in Coast Fortifications—Transmission of Intelligence, Submarine Mines and Searchlights.

BY L. B. BENDER, FIRST LIEUTENANT COAST ARTILLERY CORPS, U.S.A.

UNTIL the outbreak of the Spanish-American war it can be said that electricity had received scarcely any serious consideration as a factor in coast defense. The defenseless condition of our seacoast cities became painfully apparent at that time, and while many makeshifts were utilized in an effort to allay the public alarm, it was recognized that there was room for tremendous improvement in the art of coast defense. In 1901 the office of chief of coast artillery was established in the War Department and the greater part of the present development may be traced either directly or indirectly to the efforts of that office. It was only natural that to electricity, which at that time was being applied in many new and successful ways, should be given an important part in the new plans of defense. Congress has been liberal in supplying the funds to carry the new plans into effect, and as a result the United States to-day has an equipment for coast defense in the army alone, to say nothing of the navy, which is the equal, if not the actual superior, of any in the world. The personnel is highly trained and some of its target practice records show an efficiency which borders upon the marvelous.

Since 1907 the authorized strength of the Coast Artillery Corps has been fixed at approximately 700 officers and 18,500 enlisted men, forming 170 companies, including forty-three submarine mine companies, and stationed as garrisons at the forts commanding the entrances to all the important harbors of the United States and the insular possessions. In the near future there will be a similar garrison at both ends of the Panama Canal. The general plan of coast artillery fortifications contemplates the generation of electric power, its distribution, and its application for the transmission of intelligence, for motors, lighting and firing explosives. These may best be considered in the order named.

### GENERATION AND DISTRIBUTION.

Judging from the number of different types of prime movers and power stations found in the service, one might infer that no very definite policy had been followed in this respect. Both central plants and isolated plants have had their champions for this service. In spite of the manifest operating economy of the central plant, it seems that the military engineers have been reluctant to assume the risk of putting all their eggs in one basket and have rather favored a division of the power plant into units of smaller size for serving individual batteries and enjoying the protection the emplacement of that battery affords. But where continuous service is demanded on a post for lighting or power purposes, and where, because of remote location on an island or sparsely settled territory, energy cannot be purchased from a commercial operating company at reasonable rates, the advantage of a central plant is so apparent that there is practically no alternative. Unless the plant installed under such conditions is well protected from the enemy's gunfire, isolated plants are maintained at the batteries for emergency use. Where energy can be purchased its use is limited to lighting of buildings and grounds, for the possibility of an interrupted supply will not warrant dependence upon it for artillery purposes.

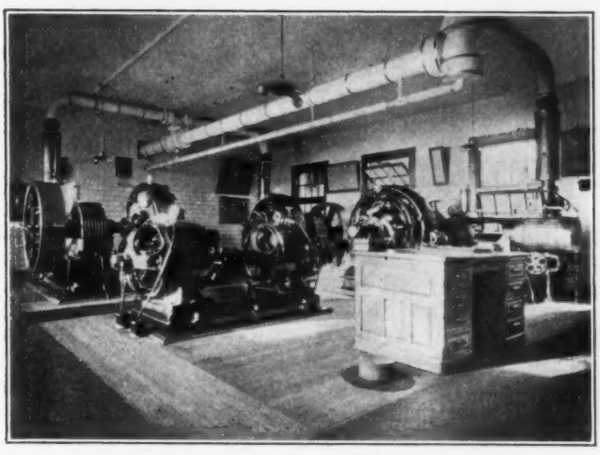


Fig. 1—Central Steam-Driven Plant.

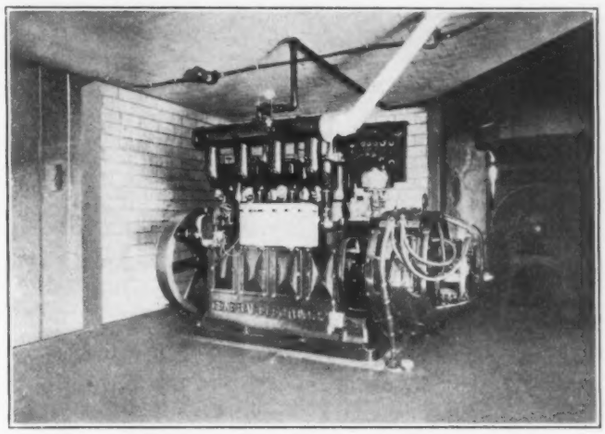


Fig. 2—Gasoline-Engine-Driven Generator.

Hand-fired water-tube boilers and simple high-speed, automatic, direct-connected engines are the rule for central plants. Compound engines and condensers are used in some places where load conditions make it desirable and a supply of cooling water is available. The generators deliver direct current at 220 volts or 110 volts, depending on the distances involved in distribution. In some cases a balancing set is used with 220-volt generators to obtain a three-wire distribution, and in at least one case three-wire generators have been employed to the same end. Storage batteries of the "chloride accumulator" type are frequently used to carry the light load from a late hour in the evening until the next day. A motor-driven booster is provided for charging the battery. The switchboards do not differ in any material respect from the standard commercial practice for such a plant. Fig. 1 shows the engine-room of a typical central plant.

The gas engine has almost undisputed sway in the isolated plants, although some small steam plants were installed for this purpose before the gas engine had reached its present high development. The most common form is a four-cylinder, water-cooled, vertical gas motor using gasoline for fuel and direct-connected to a 25-kw, 110-volt direct-current generator, the entire set being made by the General Electric Company. A motor-driven fan plays on a corrugated-metal radiator to cool the circulating water. A two-panel switchboard is used with such a plant, one panel for the generator and the other for the feeders. Fig. 2 shows a generating unit of the type described and Fig. 3 shows a similar plant of Westinghouse design.

Distribution from the power plants to batteries, stations and other points of application is almost entirely by lead-covered, rubber-insulated single conductor and duplex cables in fiber or tile conduit. An underground system is a necessity since no overhead construction could be protected from gun-fire.

### TRANSMISSION OF INTELLIGENCE.

The means employed in directing with accuracy the fire of a battery on a designated target, together with the scheme and use of the installation, constitute what is known as a "fire-control system," and electricity finds one of its most important applications here. Certain data have to be collected from distant points for computation and the result has to be transmitted for use at the guns. Atmospheric conditions have an effect on the flight of a projectile and must be taken into account before the gun can be fired with any hope of accuracy. So a meteorological station is equipped for determining the direction and velocity of the wind and the temperature and barometric pressure of the air. This information is electrically transmitted to the computers and there continually exhibited on dials by pointers which are controlled through electromagnetic ratchets by an operator in the meteorological station.

Without going into the details of position finding, it will be sufficient for our present purpose to say that the general problem is one of triangulation which is solved by mechanical means every few seconds. The actual time consumed in solving the problem may not exceed ten seconds, but observations on the target are taken at intervals of fifteen, twenty or thirty seconds, the time depending on the type of battery and the skill of the operators. To insure simultaneous observations from different points, single-stroke electric bells are installed near the observers and controlled by a clock which can be set to close the circuit at any of the intervals named.

The ready application of the telephone to a wide variety of requirements, together with its comparative simplicity of operation, makes it especially valuable in fire-control work. For some time an effort was made to utilize commercial types of telephones for this service, but after many trials and failures it was determined to design a line of instruments to meet the peculiar needs. The principal features demanded were a system and instruments capable of long continuous operation, a rugged construction, reserve current supply for emergency use, and a standardization of all parts of the instrument irrespective of the containing box, which must depend largely on its location. These requirements were satisfied by a telephone of special design known as the "composite artillery type" telephone, to be normally operated from a 30-volt storage battery as a central-energy system, but provided with local batteries for use in emergency by throwing a switch on the instrument. Transmission is equally effective by either method. Since practically every telephone is in use at the same time on fixed lines of communication, there is little need for switching facilities under normal conditions. However, a provision is made for switching some of the more important lines on a panel of the controlling switchboard by means of bridging plugs in case of emergency. A unique feature of the instrumental design lies in the fact that the apparatus is divided into "auxiliary sets" and "talking sets" so arranged that any form of transmitter and receiver combination or "talking set" may be used in conjunction with any of several forms of "auxiliary sets" according to local conditions. One of the talking sets consists of a head harness supporting a watchcase receiver on one ear and the transmitter with a curved hard-rubber mouthpiece on the other. Both the transmitter and receiver are fitted with soft rubber cushions which exclude all external sounds.

For transmitting data from the computing room to the guns, use has been made of the telautograph in addition to the telephone. This consists of a transmitter and pilot receiver mounted within view of the operator, connected with one or more receivers located at the guns. All movements imparted to the transmitter pencil by the operator when writing a message are reproduced in the several receivers in the shape of a written record through a system of current-carrying coils working in a magnetic field. Careful adjustment and a power supply absolutely free from voltage fluctuations are necessary for successful operation. The latter is obtained from a storage battery of sixty cells.

All storage batteries, charging machines and controlling apparatus required by several units of a fire command are housed in one building in some protected location. Here will be found a 25-amp to 70-amp, sixty-cell storage battery of the lead type in glass jars for the telautographs. In the same room is a fifteen-cell, 10-amp or 15-amp storage battery of the same type for supplying current to the telephones and signals. The larger battery is charged by a motor-driven, constant-current booster, and the smaller by a motor-generator set, both being supplied with power from the power plant. A power switchboard of three panels controls the two batteries and charging machines. A distributing switchboard is furnished to control the telephone, signal and telautograph circuits. Fig. 4 shows a typical installation with the power board on the right and the distributing board on the left. Distribution for the fire-control system is by underground lead-covered, rubber-insulated cable, usually in the same conduit lines with the power cables. It is often necessary for such cables to cross stretches of sea water, and for this purpose armored, lead-covered, rubber-insulated or paper-insulated cable is used.

In addition to the fire-control telephones, there is a post telephone system connecting all offices, barracks, quarters, storehouses, etc., for administrative purposes. This is a central-energy system using the same storage battery as the fire-control system and using standard commercial types of apparatus throughout. A manually operated switchboard is provided and the distribution is by aerial or underground cable.

At least one wireless telegraph station is installed in each defended harbor and in time of peace has its principal use as a means of communication with the tugs towing targets for target practice. In time of war it would probably be used to facilitate co-operation between the land forces and the navy. The usual shore station has the flat-top marine-type antenna supported by two 75-ft. masts set 150 ft. apart. The leads to the antenna drop from the center of the span and pass into the station in two high-tension cables through heavy partition insulators. A radiating ground of No. 9 galvanized wire is located directly under the antenna and covers approximately 200,000 sq. ft. This is further extended by connection to water mains when possible. Power is obtained from a 1-kw motor generator set supplying single-phase, 120-cycle, 100-volt current. The tugs have the same type of antenna as the shore station, but only 45 ft. above the water line. A ground is obtained through the steam-heating system of the ship connected to the iron hull. Power is obtained from a 17-volt storage battery.

### MOTOR DRIVE.

In handling ammunition for the service of a heavy gun battery it is necessary to raise it from the magazines and shot-rooms to the loading platform about 15 ft. above. The charges of powder are divided into sections so that four men can handle a complete charge. But the projectiles may exceed 1000 lb. in weight and must be handled by mechanical means. These are rolled on to a receiving table, where they are picked up by a cradle on a motor-driven hoist and delivered to the delivery tables above for transfer to the loading trucks. The hoist is driven by a shunt-wound motor having a drum-type starting box and speed controller.

Disappearing guns are brought into the firing position by the action of a weight and are returned to the loading position by the recoil following discharge. When the gun is being used for drill purposes some mechanical means is necessary to retract it from the firing to the loading position, since there is no discharge. For this purpose a 4-hp to 8-hp motor is geared to a drum on which are wound two retraction cables, thus pulling the gun down in a fraction of the time it could be done by hand power.

Motor drive has been applied to the traversing and elevating mechanisms of guns of the larger caliber, but with only partial success. The requirements of this application are so exacting that no system so far devised has proved entirely satisfactory. A range of speed is demanded extending from zero through infinitesimal increments to the maximum. The movements of a target in range or azimuth may be so small as to require careful observation to detect, while, on the other hand, a change in targets may demand a movement through 90 deg. or more in the shortest time possible. Every condition between these extremes must be provided for. A modified Ward-Leonard system furnished by the General Electric Company more nearly meets the requirements than some others tried. It consists of a 6-hp shunt-wound motor direct-connected to a 3-kw compound-wound generator located with its controlling switchboard in a well-protected room of the emplacement of the gun to be served. The traversing motor is a shunt-wound 4-hp machine having its fields excited directly from the 110-volt power circuit. A drum-type controller, with the operating shaft extended to the gun pointer's platform, furnishes a means of varying the current in the separately excited field circuit of the generator through wide limits. As the gun carriage approaches the limit of travel in either direction, automatic stops return the controller shaft to the "off" position. The motor used for retraction is also made to serve the elevating mechanism through an idler capable of being moved through an arc to engage the motor with either the retraction or elevating gearing. This motor is also equipped with a drum-type controller, but speed variation is effected entirely through the motor fields.

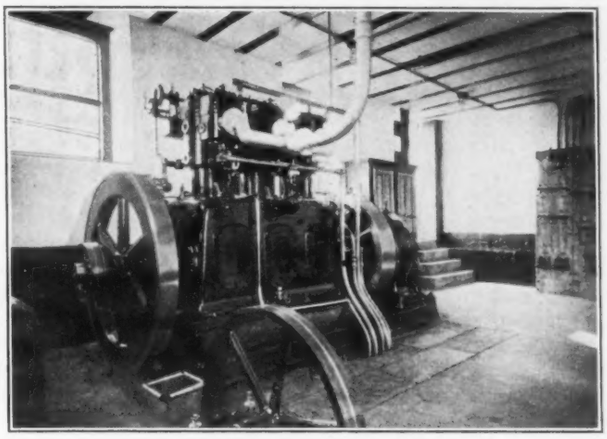


Fig. 3—Gasoline-Engine-Driven Generator.

### LIGHTING.

For electric lighting of magazines, shot-rooms, galleries, etc., lead-covered, armored cable with water-tight outlet boxes and fittings is used because of the damp concrete walls and ceilings often encountered. Exterior lamps are provided in the walls of the emplacement, supplemented by clusters with deep cone reflectors for lighting the gun and loading platforms during night drill or action.

The defense of harbors at night would be all but impossible without searchlights. These are used in sizes up to 60 in. in the stationary type and 36 in. in the portable type. The lamps have automatic feeding mechanisms for the carbons, and the stationary type has a rheostat in series with the arc to make the 110-volt power circuit available for the arc. The 60-in. lamp (Fig. 5) uses carbons 2 in. in diameter and requires a current of 200 amp with 65 volts across the arc. Such a projector can be depended upon to disclose a ship at 9000 yards under ordinary conditions. Movement of the beam in direction and elevation is accomplished by means of two small motors controlled through relay switches by a controller located at a distant point.

It is sometimes desirable to have a portable searchlight, and such an outfit, including a portable power plant, has been designed and furnished for the service. The lamp is essentially the same as the stationary type except that it has no rheostat and is mounted on a truck with 500 ft. of power cable and 1000 ft. of controller cable wound on a drum. The lamp is arranged to be elevated by a screw to a position about 6 ft. above its normal position when on the road. The power plant is mounted on a separate truck and consists of a vertical three-cylinder gasoline engine direct-connected to a direct-current generator giving 130 amp at 74 volts. The generator has a series field and a separately excited differential field, the latter being excited by a 110-volt, ¾-kw exciter mounted on the engine shaft. Rheostats are provided for both the exciter and generator fields, and any increase or decrease of current at the arc is promptly and automatically corrected by the opposing field windings. The exciter also furnishes current for the 110-volt training motors in the base of the projector.

A novel but effective use of searchlights has recently been made by fitting their faces with shutters to operate as great heliographs for signaling. By this means messages may be flashed a distance of 10 miles without difficulty even on the brightest day.

### SUBMARINE MINES.

One of the most intricate and extended applications of electricity is in connection with firing explosive submarine mines, but unfortunately the details of this service are more closely guarded from the public than any other, and for that reason only a very broad, general idea of the subject can here be given. The mines are ordinarily planted in groups, each mine being connected by cable to a submarine distributing box, which is in turn connected with the controlling station on shore. A position-finding system is provided so the mines in the vicinity of a hostile ship may be exploded, even though they may not have been actually touched. The mining casemate on shore houses a small power plant, a storage battery and controlling switchboards for the mine service. The mine fields are illuminated by searchlights to expose to gun-fire any cable-cutting expeditions of the enemy.

### ORGANIZATION.

The district commander of each artillery district has on his staff an officer known as the district artillery engineer, who is accountable for all equipment furnished by the signal corps and engineer corps for artillery use in his district.

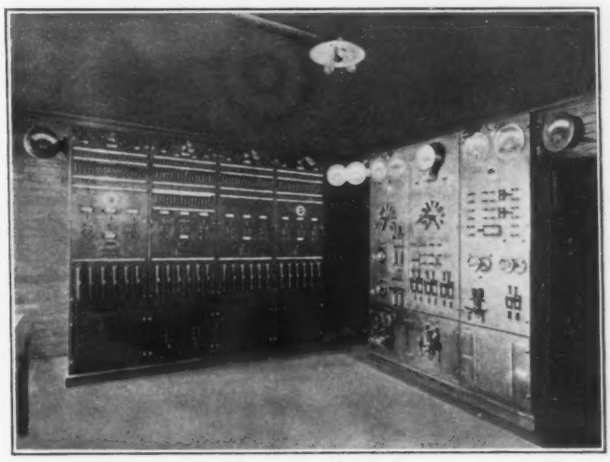


Fig. 4—Fire-Control Switchboards.

At each post in the district is an officer known as the post artillery engineer, who is responsible for the proper operation and maintenance of the installations at his post and is assisted by such enlisted specialists, including master electricians, engineers, electrician sergeants, master gunners

and firemen, as may be assigned to the post. An examination both practical and theoretical is required for appointment to the enlisted grades named, and an excellent class of men is the result. The coast artillery school maintained at Fort Monroe, Va., provides technical instruction for both officers and enlisted men. It is well equipped with laboratories and competent instructors and has been notably successful in its work. It is worthy of note that, with all the highly developed electrical and mechanical apparatus and equipment in service, it has been maintained and operated exclusively by the military personnel. This record deserves a serious thought from those in civil life who sometimes lament the low order of intelligence pervading the rank and file of the army.

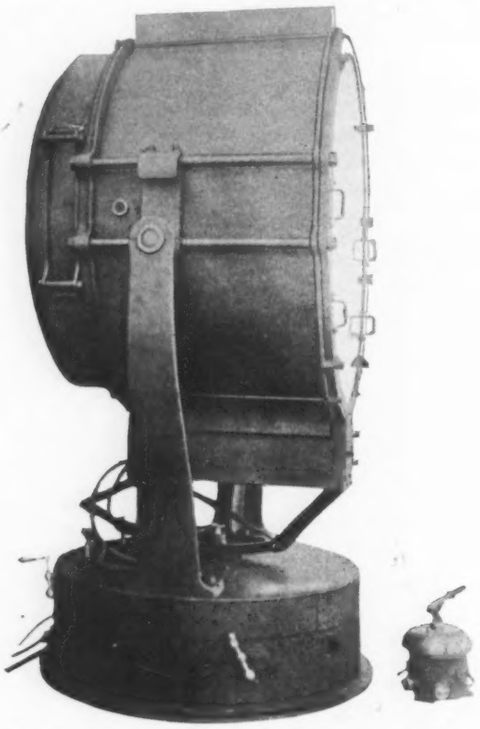


Fig. 5—60-in. Search-Lantern and Its Controller.

Credit is due the *Journal U. S. Artillery* for the cut shown as Fig. 5 and to Master Gunner Pixley for photographs used.

## THE HYSTERESIS TORQUE OF INDUCTION MACHINES.

By Dr. Hans Riddervold.

It is a well-known fact that the non-synchronous three-phase machine when operating below synchronism acts as a motor, while when operating above synchronism it acts as a generator. When the machine is belted to a shunt motor and is connected to constant voltage and constant frequency terminals, the shunt motor being connected to a constant-voltage supply system, the input into both machines at different speeds can easily be measured. Especially interesting is the torque of the induction motor near synchronous speed. By increasing the speed of the set through synchronism there is obtained a sudden decrease of power input into the induction motor and a corresponding increase of the power input into the direct-current motor when passing through synchronism.

The losses of a light-running induction motor are friction and windage, copper losses and iron losses. As an approximation it is often assumed that the slip is proportional to the power transferred to the rotor when the slip amounts to only a few per cent. At no-load the hysteresis, eddy current and copper losses of the rotor are very small, and the power transferred from the stator to the rotor would in this case be only the friction and windage. Assuming the slip proportional to the transferred power, it seems as if two readings of the slip at no-load (friction losses) and at a known load (friction losses plus load) would give a determination of the friction losses. However, according to this plan no account is taken of the torque of the stator currents on the rotor attributable to the hysteresis and eddy currents in the rotor. In commercial machines this torque is small compared with the full-load output, but it cannot be neglected when compared with the friction losses.

The torque on the rotor when running at no-load consists of (1) hysteresis torque, (2) torque of the eddy currents in the rotor, (3) friction and windage and (4) a torque proportional to the slip. If the torque in the direction of the motion be designated as positive (1) is positive below synchronism, negative above synchronism, (2) and (3) are negative and (4) is, as mentioned, positive for a positive slip, negative for a negative slip. In some few cases the hysteresis torque is great enough to overcome the friction and windage, so that the machine in this case will run at exact synchronous speed at no-load.

Although it is often convenient to connect an induction motor to a direct-current motor in order to measure the input into the two motors, yet it is not advisable to use this method for the determination of the hysteresis torque unless the secondary winding of the induction motor is open. Upon closing the secondary winding there is obtained an input into the stator equal to the no-load losses when the slip is the same as obtained in an actual no-load run. Upon increasing the speed the input decreases until the input becomes zero at a certain negative slip, the total current input being wattless. The negative slip will in this case be considerably less than 1 per cent. At higher speeds the induction machine acts as a generator, the current always being a lagging one. Varying the slip from a few per cent positive to a few per cent negative, the input is changed from

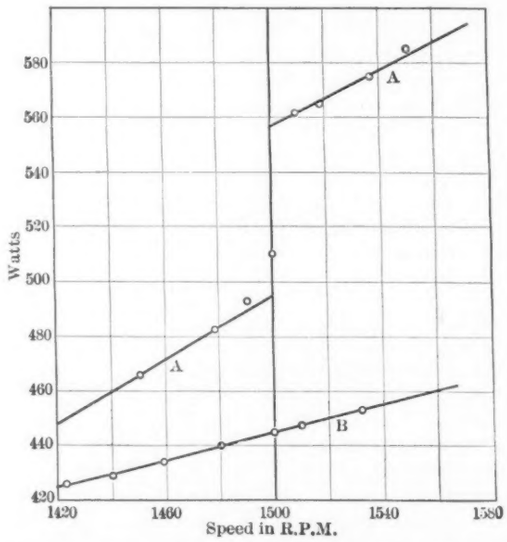



Fig. 1—Power Input at Speeds Near Synchronism with Secondary Open.

full output of the motor to full output of the induction generator.

The hysteresis torque helps the rotation of the induction machine when acting below synchronism and opposes it when acting above synchronism. Upon connecting the direct-current motor to the induction machine there is obtained a sudden increase of the input into the direct-current motor equal to twice the hysteresis torque when the speed

of the induction motor passes through synchronism. The accuracy obtained by this kind of measurement is about 1 per cent. One cannot expect accurate results in measuring the increase in power consumed at synchronism as long as this increase is small compared with the change in the input when the slip varies by only a few per cent. This will be the case if the secondary winding is closed. In this

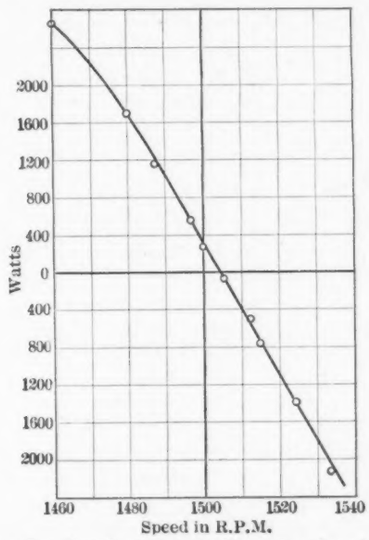



**Fig. 2—Power Developed at Speeds Near Synchronism with Secondary Closed.**

case the torque of the rotor which is proportional to slip is many times as large as the hysteresis torque. By leaving the secondary winding open one avoids the torque that is proportional to the slip. For an experimental investigation of the hysteresis and eddy current torque on the rotor it is advisable to connect the machine under test to a shunt motor large enough to supply the losses of the induction machine.

In experiments made at the University of Hanover, Germany, a 5-hp, 190-volt, 1500-r.p.m., three-phase Koerting induction motor was belted to a shunt motor. The power intake of the shunt motor was determined for different speeds near the synchronism of the induction motor; the secondary winding was left open and the stator winding was connected to a 190-volt, 50-cycle, three-phase supply. Fig. 1 shows the power intake (in watts) of the shunt motor as ordinates, with the speed of the induction motor as abscissas. The readings (indicated as circles in the diagram) show at a glance the increase of the input into the shunt motor corresponding to twice the hysteresis torque (curve A). It will be seen that this hysteresis torque amounts to about 30 watts—"synchronous watts." Another test was made under the same conditions except that the primary of the induction motor was disconnected from the supply system. Curve B shows the input into the direct-current motor in this case. Now, the direct-current motor delivers only the friction and windage losses of the induction motor. The difference in the ordinates of curve A and curve B corresponds to the hysteresis and eddy-current torque of the induction motor. At synchronous speed it will be seen that the torque of the rotor eddy currents corresponds to 80 watts. As the no-load losses of the direct-current motor alone are 256 watts, the friction and windage losses of the induction motor at synchronous speed are 189 watts; the copper losses of the armature of the direct-current motor are here neglected.

Under normal running conditions of the induction motor with short-circuited slip-rings there is obtained a different input into the direct-current motor when making similar tests. Fig. 2 shows the relations under these conditions; the ordinates give the input into the direct-current motor; the abscissas the speed. The power transferred from the direct-current motor to the induction motor is considerable. A sudden increase of the power input of the direct-current motor when passing through synchronism cannot be measured by this method, hysteresis torque being too small compared with that torque of the rotor which is proportional to the slip.

## NEW CENTRAL STATION FOR FALMOUTH, MASS.

Plans have been drawn for the erection of a new central station for the Buzzards Bay Electric Company at Falmouth, Mass., the proposed location being on the west shore of Deacon's Pond Harbor. The plant will have several novel features in spite of its small capacity, the initial installation being designed for reciprocating-engine and exhaust-steam-turbine operation. The building will be large enough to house about 1500 kw in generating machinery, and will be 65 ft. by 130 ft. in plan, with Greek pillars at its front and low sloping roof surmounted by a chimney resembling the chimney of a typical Colonial country house. Provision will be made for the delivery of coal by water, and the coal storage will be hidden from view.

The initial boiler plant will consist of two 78-in. x 20-ft. horizontal-return tubular units, and these will supply a horizontal cross-compound reciprocating engine with direct-connected generator, the engine delivering exhaust steam to a low-pressure turbine direct-connected to a 250-kw alternator. The latter machine will be tied in rigidly on the busbars with the former. The unique features of the plant include the discharge of the products of combustion at the rear of the boilers and thence over the tops; the delivery of the gases thence to an economizer designed for superheating the exhaust steam from the engine before it reaches the low-pressure turbine; the discharge of the flue gases into another economizer section equipped for feed-water heating, and the filling of the space between the walls of the boiler setting with magnesia and asbestos instead of the provision of the customary air space. When the flue gases first leave the boiler they will be utilized in drying the steam led to the engine unit. A surface condenser will be installed in connection with the low-pressure turbine, and circulating water will be drawn from the harbor. Town water will be used for boiler feeding.

The company is now installing a 40-kw, 2300-volt unit driven by a gasoline engine at Hyannis, and energy is being supplied from the present temporary steam station at Falmouth through the territory from Woods Holl to Waquoit. Lines are being extended from this plant through West Falmouth and Chappaquoit to North Falmouth and Megansett, with the expectation later of establishing distribution facilities in Cataumet, Pocasset and Monument Beach. All of this territory, which includes summer colonies of growing importance, will be supplied in the coming season, service being planned to cover a radius of about 20 miles from Falmouth. From the gasoline station at Hyannis a line will be extended through Barnstable, Bourne, Sandwich, Sagamore, Osterville and Cotuit. Eventually these scattered settlements will be tied to the Falmouth plant by a 33,000-volt transmission line.

The Carpenter interests, of Newton, Mass., controlling the central-station properties at Buzzards Bay and Martha's Vineyard, have lately purchased the gas plants of Hyannis and Cotuit. Since 1908, when the present interests assumed control, the annual income has been increased from $13,000 to $44,826, including the electric traction lines at Oak Bluffs. A policy of modernizing the equipment has been inaugurated, new business methods have been introduced and operating economies instituted. Special success has attended the installation of flat-rate tungsten lighting in residences, and considerable attention has been given to the cultivation of off-peak power business. The active management of the properties is now in the hands of Mr. Eugene Carpenter.

# Central Station
## Management, Policies and Commercial Methods

### POWER LOAD IN LOUISVILLE.

The Louisville Lighting Company reported that for the second week in March it contracted for industrial business amounting to 1600 hp. With a dozen men soliciting business, the company is rounding up a lot of desirable trade. Widely diverse lines are being secured, such as the Louisville Veneer Mills, which will use motors to operate large veneer saws, gluing machines, presses, etc., and the Drummond Manufacturing Company, which manufactures cast-iron axles. Prospects for business are excellent, according to Mr. A. T. Macdonald, general sales manager of the company.

### ENERGY CONSUMPTION IN BAKERY.

A bakery at Springfield, Ohio, having an output of 125,000 loaves per month, has a total connected motor load of 11.5 hp. The machines driven include a 2000-lb. freight elevator, one three-barrel mixer and one five-barrel mixer, a dough break, a loaf former, a cake mixer and one pan greaser. From twelve months' consumption of this bakery, recorded by Mr. J. North, contract agent for the Springfield company, the average monthly use has been 419 kw-hr. This represents about 3.3 kw-hr. per thousand loaves of bread baked.

### ELECTRICALLY HEATED CREMATORIES.

An electrically heated crematory with three retorts has been operated successfully during the last three months at Oakland, Cal. A similar single crematory is also in use at Pasadena, Cal. Each retort comprises a brick-lined arched chamber along the two sides of which are fixed 12-ft. ⅝-in. calorite resistor rods bent double to form 6-ft. lengths. With three rods to each side, the resistor equipment of each retort totals about 72 ft. of ⅝-in. rod and takes 85 kw. The body, inclosed in its casket, is put in place with the retort cold. In 30 to 60 minutes after turning on the current the temperature in the chamber rises to 2000 deg. Fahr., the organic products undergoing distillation. In another hour nothing remains but the mineral matter and ash, which are collected on the clean tray beneath. Electric cremation lacks the terrifying flame and roar, as well as the objectionable dirt, of ordinary incinerating plants, and the furnishings of the building may be made equal to those of any chapel. The electric crematory at Oakland has been used to incinerate half a dozen bodies in a single day and is kept busy meeting the demand for its service. The fee for cremation there is $50, at which rate a substantial profit is made over the cost of energy, plant, investment, etc.

### A DIRECT-BY-MAIL HOUSE-WIRING CAMPAIGN.

Last year 1200 old houses were wired in Cleveland, the sales staff of the Electric Illuminating Company and the men employed by the co-operating contractors each closing almost exactly one-half of the total number of orders. During 1912 it is hoped to wire 2000 old residences, for already the campaign has gathered headway with eighty contracts taken in January and 140 in February, usually the two dullest months of the year.

For some time the central-station solicitors have been collecting names of old-residence "prospects." During the next six weeks the 6000 names thus received will be made the subjects of a house-wiring campaign by mail. Four letters and the attractive Cleveland booklet, "Wiring Old Houses," comprise the ammunition to be fired successively at each "prospect." Letter No. 1 explains the campaign; letter No. 2 will contain a reply card. The twelve contractors co-operating with the central station in this campaign have each agreed to keep at least one salesman engaged exclusively in soliciting old-residence wiring. As the responses to the central station's mail campaign come in, they will be turned over to the several contractors in the same proportion that house-wiring orders were received from these contractors during the preceding month as the result of their own sales efforts.

### PLOTTING A CONSUMPTION CURVE FOR EACH CUSTOMER.

Each month before the bills go out to the lighting customers of the Columbus Railway & Light Company each customer's consumption is plotted on his individual curve-sheet, which forms a part of the office records. These readings are then scrutinized by an experienced man, and if the last point falls much above or below the customer's ordinary consumption, an investigation is made before the bill is sent out. In this way 90 per cent of the excess-reading errors are caught without even the customer's knowledge of their occurrence. Under-readings from any cause, damage of meter by lightning, etc., are also located from the curve sheet, in time to investigate the installation for reader's error, meter trouble or other cause. The man who checks the records must, of course, make allowance for the season changes in the customer's consumption, but with experience he learns the characteristics of each class of business, besides having the record of previous years for comparison. The customers' curve sheets are arranged in ledger form, each page giving space for twenty-four months or two years, the record being continued at the first month again in a different color of ink. As the average consumer tends to increase his use of electricity from year to year, there is little trouble from superposition of the curves of succeeding two-year periods. Any increase in connected load contracted for by a customer is entered at the corresponding month division of his individual curve sheet, so that the checker may know when an otherwise unexplained increase occurs in consumption. The kilowatt-hours' use of every commercial, "power" and residence consumer in Columbus has been recorded in curve form in this way since 1907, and the plan has been found of the greatest service in checking and studying customers' consumption.

### SECURING CO-OPERATIVE INTEREST OF ARCHITECTS.

Electrical literature contains many references to the lack of sympathy sometimes found between architects and the central-station companies, and to offset this the Rochester Railway & Light Company has mailed an individual letter to each of the architects in Rochester, which has been received favorably by the members of that profession. The letter, the gist of which follows, is characteristic of the public policy campaign of the Rochester company and betrays on its face one of the secrets of the success of the company in this direction. It is purposed to follow the individual letters with circulars and probably with a loose-leaf booklet specially arranged for architects, in which gas

and electric suggestions will be offered from time to time, such as, for instance, the use of a central ceiling lamp in the laundry and provision for small red pilot lamps in connection with flatirons and on cellar stairs, etc.

The letter is signed by the mechanical and electrical engineer of the company and is prefaced with a paragraph acknowledging the company's appreciation of the fact that the technical considerations in connection with the mechanical and illuminating equipment of any home or other building must be made secondary to the high requirements of art and of the fullest convenience and utility in the building, and approaching the work in this spirit the writer suggests that, with the architect acting as a check on the company's engineering judgment, the specialized skill of its organization should be able to work quite close to the ideal. The organization and ethical standard of its technical staff are then brought to the attention of the architect in the following well-chosen words:

"In the first place, as you undoubtedly know, it is the feeling of each individual man in our commercial and engineering departments, a feeling which is thoroughly indorsed and, in fact, insisted on by the management, that we should never attempt to secure any class of business which we could not conscientiously recommend to the customer were he our client and we his fiduciary agent."

The work and qualifications of the technical staff are next given briefly and concisely, and the mechanical and electrical engineer of the company concludes the letter with the following invitation:

"What I should like to do is to place this staff of men at your service, to work with you on any of the details of your work where they may happen to have specialized knowledge. Their services are yours for the asking, and they are both by disposition and by training able to cooperate in a spirit of sympathy with the highest requirements of your work. If you can use us at any time, kindly telephone and we will have a man at your office within five minutes."

## A METHOD OF INVESTIGATING AN EXISTING RATE SCHEDULE FOR MOTOR SERVICE.

By F. B. Fletcher.

It is at times desirable to gain a general view of the motor-service situation on a central station's lines, and at the same time to have as complete information as possible on these conditions. Among those plants which would be benefited most by such a survey are the smaller central stations where the motor consumers are relatively few and where an investigation can be made most easily and cheaply. With some stations of this class, as well as with a few larger ones, existing motor-service rates are largely the result of competition with other forms of energy, and large sacrifices are often made to "get the business." Or the opposite extreme may be the case, imposing prohibitive rates upon a field of industry which, properly developed, would prove a large and growing source of revenue.

The following discussion will therefore deal with the methods of collecting and compiling a general review of this kind.

The basis upon which this investigation is to be made is the individual maximum demand of each consumer. Such maximum demands can be accurately obtained only by the use of maximum-demand meters for direct-current, or graphic recording wattmeters for alternating-current circuits, these instruments being placed on the consumer's installation and allowed to remain there until an average cycle of industrial operations has elapsed. Meters registering the maximum power requirements for a period of ten or fifteen minutes are preferable, since they make no note of excessive currents required for starting. This starting current can be considered as taken care of by the overload capacity of the generators at the power house, and should not be confused with the demand peak of the motors. Where the number of instruments is limited, and they must be moved from one consumer to another, a week's time per consumer will probably suffice.

All other necessary data may be obtained from the customer's books, the company's annual or monthly report, and from calculation. The customers' bill sheets will give the required information regarding the connected load, net monthly bills and kilowatt-hours used per month, while the company's report will yield data for the calculation of the actual cost to manufacture electricity.

To assemble this data and the resulting quantities in usable form, an arrangement similar to that given in Tables I and II may be used.

Considering Table I, column 1, "character of service" may best be arranged alphabetically according to the business of the consumer, as "bakers," "breweries," "butchers," "candy factories," etc. The quantities and percentages given in the succeeding columns refer, of course, to the class of consumers listed in column 1. Column 2 is taken from the customers' books, as are likewise columns 5, 6 and 8. For average quantities twelve-month averages should be taken, and, as is shown by the headings, such quantities are the sums of the individual requirements of each consumer falling in that class. Column 3 is the summation of the maximum demands of all the consumers covered by the class under consideration, and column 7 is obtained by dividing column 6 by column 5. The average load factor is the "true load factor" of each class of consumers. By the "true load factor" is meant the ratio of the average kilowatt-hours per month to the maximum demand multiplied by 720, 720 being the greatest possible number of hours' use of the maximum demand per month.

A glance at the headings of Table I will show the general usefulness of the information obtained therein. The value of any desired class of consumers can be readily examined from three different viewpoints; those of the load factor, the kilowatt-hours consumed and the total monthly bills. The actual average income per kw-hour of one class may be compared with a class giving either a greater or less total net income and a measure of the value of the first class of business be thus obtained. In short, Table I shows where to push business, where to curtail it and from what source the largest and most profitable motor load is derived.

Table II is compiled from the same fundamental data as Table I, but represents another side of the motor-service situation in an interesting and instructive way. Here all consumers are divided into classes, according to the number of hours' use of the maximum demand per day, by dividing their total average kilowatt-hours per month by thirty times the maximum demand in kilowatts. Having separated the motor users according to this arrangement, the data for columns 2, 6 and 8 may be collected from the customers' ledgers and the percentage columns obtained by dividing each class total by the total footed up for the respective columns.

Column 10 deserves especial attention, as in it unit figures are given which are directly comparable with the existing motor rate of the central station. It is hardly necessary to mention the value of the respective columns and their relation to each other, as this is sufficiently evident from an inspection of the table.

Since a final and general view of a situation is almost always necessary in summing up its advantages and disadvantages, curves are plotted from the data in hand which show the conditions most clearly.

In these curves hours' use per day, as abscissas, are plotted against cost in cents per kw-hour, as ordinates. All motor rates, no matter of what form, may be reduced to

these basic components by simple substitution and proper arrangement. And, since the data from Table II, column 10, present themselves in this form, it will be found simpler to adopt these values as co-ordinates.

Curve 1 presents the actual cost of manufacturing energy.

TABLE I.—ANALYSIS OF THE CLASSES OF SERVICE OF POWER CONSUMERS.

| 1<br>Character of Service. | 2<br>Total Installed Horse-Power. | 3<br>Total Maximum Demand, Kilowatts. | 4<br>Average Load Factor, per Cent. | 5<br>Total Kw-hours per Month. | 6<br>Total Net Monthly Bill in Dollars. | 7<br>Actual Average Cost to Consumer in Cents per Kw-hour. | 8<br>Number of Installations Upon Lines. |
|---|---|---|---|---|---|---|---|

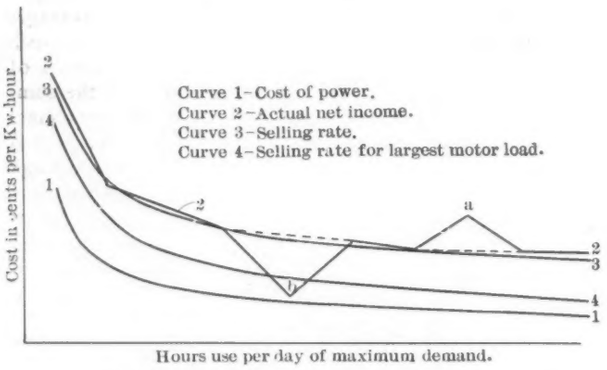
The equation of this "cost-of-energy" curve assumes the hyperbolic form and is obtained as follows. The component parts are

$I$ = the investment charge in dollars per kw per month.

$M$ = the manufacturing charge, or cost of manufacturing and maintenance at the power house, in dollars per kw-hour.

$X$ = the number of hours' use of the maximum demand per month.

$Y$ = the cost in cents per kw-hour.


Curve 1–Cost of power.
Curve 2–Actual net income.
Curve 3–Selling rate.
Curve 4–Selling rate for largest motor load.
Cost in cents per Kw-hour
Hours use per day of maximum demand.

Variation of Cost of Energy with Maximum Demand.

The definition of $M$, as given above, assumes that motor service is off-peak business, which is the real distinction between a lighting and a "power" rate. With this data the equation of the curve becomes

$$Y = \frac{M X + I}{X} \qquad (1)$$

From the equation it can be seen that the differential is the number of hours' use per day, and that the rate of change of $Y$ is no function of either $M$ or $I$. Hence the same cost per kw-hour would apply to any size motor operating the same number of hours per day. By means of this equation, values of $Y$ may be calculated for corresponding values of $X$, and the resulting quantities plotted to show Curve 1.

If this equation is desired to give a space relation, or, in other words, if the cost-of-energy curve could be better shown as a solid, the transformation may easily be made by substituting for the time co-ordinate $X$ the two related co-ordinates, $M$ (consumption in kilowatt-hours) and $B$ (maximum demand in kilowatts). The mathematical relation then becomes

$$X = \frac{A}{B}$$

Substituting in equation (1)

$$Y = \frac{\frac{A}{B} \cdot M + I}{\frac{A}{B}}$$

$$Y = \frac{A M + B I}{A}. \qquad (2)$$

Equation (2) is the equation of a hyperbolic paraboloid.

Curve 2 is obtained from values given in Table II, columns 1 and 10, and shows the variations in the cost per kw-hour for the different hours' use per day of the maximum demand. Thus, one-hour users pay, as a class, the value in cents per kw-hour given on the first line of column 10. Theoretically Curve 2 should parallel the cost-of-energy curve, but, owing to conditions which have grown out of practice and perhaps to the form of the selling curve for energy, these conditions will not often occur. Indeed, it is the object of this investigation to determine how closely the *actual* selling rate conforms to the actual cost of energy.

Two irregularities are possible in Curve 2—a downward deflection as at *b* or an upward deflection as at *a*.

A downward bulge of the curve as at *b* could mean one of two things, either that some very large consumer (or consumers), to whom special privileges were granted, pulled down this class of users far below normal or that this entire class was receiving too low a rate. Either of these conditions might bring the selling price to this class of consumers dangerously near to the cost to manufacture energy for the number of hours' use per day corresponding to that class. This has been purposely shown in the curve.

The reverse applies to a possible upward deflection as at *a*, disclosing that some large consumer (or class of consumers) is paying a discriminatory rate for power.

Having found the exact location of an irregularity by this method, its cause may be investigated and remedied if, with due regard to local conditions, this is thought advisable.

In connection with the curve sheet curves may be plotted showing the selling rate, or rates, for motor service. If one rate only, as Curve 3, is in force, this rate should conform closely to Curve 2. If more than one rate is in effect, or if the selling rate varies with the size of the installation,

TABLE II.—ANALYSIS OF THE HOURS' USE PER DAY OF THE MAXIMUM DEMAND OF POWER CONSUMERS.

| 1<br>Hours' Use per Day of Maximum Demand. | 2<br>Connected Load. | 3<br>Maximum Demand, Kilowatts. | 4<br>Per Cent of Connected Load Active. | 5<br>Per Cent of Total Connected Load. | 6<br>Kw-hours Sold per Month. | 7<br>Per Cent of Total Kw-hours Sold. | 8<br>Net Income per Month in Dollars. | 9<br>Per Cent of Total Net Income | 10<br>Actual Net Income per Kw-hour in Cents. |
|---|---|---|---|---|---|---|---|---|---|
| Under 1 hour..... | | | | | | | | | |
| 1 hour to 2 hours..... | | | | | | | | | |
| 2 hours to 3 hours..... | | | | | | | | | |

a curve like 4, showing the rate of the largest "power" consumer on the company's lines, should be drawn in. This curve will show the limiting values to which the company's motor-service business has proceeded at the time, and may form a valuable guide to the advisability of taking on other large motor loads.

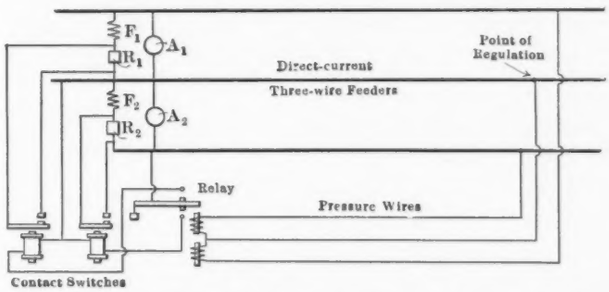
The data as laid out above are all that is necessary for a commanding view of the motor-service situation of any central station, and are easily within the reach of any central-station manager. However, such data are valueless unless accurately and intelligently collected and arranged.

With such an arrangement of "power" statistics a central station can be prepared to take a commanding grasp upon the situation should a competing form of energy arise, and have at the same time a reliable index of its existing power condition.

# Wiring and Illumination

## APPLICATION OF TIRRILL REGULATOR TO ADJUST BALANCER FOR NEUTRAL REGULATION AT DISTANT POINT.

The unbalancing action on the 110-220-volt Edison three-wire system of the Dayton Lighting Company is unusually severe owing to the presence on the lines of several large 110-volt elevator motors. A 90-kw balancer set is provided to adjust the voltage differences on this direct-current system, the load on which varies from 1000 kw to 1800 kw. This balancer has its fields adjusted by a Tirrill regulator, the control of which can be effected from any one of fourteen sets of pressure wires brought back from as many points in the downtown network, so that the neutral pressure can be kept practically constant at this given point, regardless of the load on the lines or the pressure at the station. Several other means were attempted in the effort to solve this voltage variation, the severity of which was such that use of a three-wire generator had to be abandoned except as a 220-volt machine feeding into the outers. The present application of the Tirrill regulator principle is due to Mr. O. H. Hutchings, general superintendent of the Dayton system, and has resulted in practically perfect regulation. The opposed-voltage relay, energized through pilot wires from the point on the network regulated for, closes in the corresponding direction when either side drops in




Application of Regulator to Adjust Three-Wire Balancer for Distant Point in Network.

pressure, operating one of the contact switches which short-circuits the corresponding field rheostat, boosting the pressure on that side. As the result a very close voltage regulation is obtained on the downtown network, regardless of the varying unbalanced loads.

Where pressure wires are not available, it may be suggested that a similar regulation for a distant point could be obtained with apparatus entirely within the station by using differentially wound relay coils, having one winding across the mains at the bus and the other bridged across a shunt in the outgoing feeders, in this way obtaining an artificial subtractive action for the drop in the feeders.

## ILLUMINATED CHURCH SIGN.

Base-filament glittering electric signs which prove so attractive for commercial institutions sometimes appear inappropriate for church use. The illustration shows a dignified and beautiful illuminated announcement erected in front of the First Baptist Church of Dayton, Ohio. The frame is of simple ecclesiastical design and incloses two

Illuminated Art-Glass Church Sign.

art-glass panels in rich colors. In the smaller panel above, the name of the church is permanently fixed, while the larger glass furnishes space for lettering in announcements of the next Sunday's exercises. The lamps within the sign are controlled from a switch in the church vestry.

## COMPLETION OF ORNAMENTAL CLUSTER POST-LIGHTING SYSTEM AT PASCO, WASH.

Pasco is a little city of 4000 people in the famous irrigated Yakima Valley, near the junction of the Snake and Columbia Rivers, in southeastern Washington. It is on the main line of the Northern Pacific and the Seattle, Portland & Spokane railroads, being a division point for both roads. The city owes its existence primarily to a heavy railroad and industrial payroll, supplemented in recent years by a rapidly increasing tributary farming district. Along agricultural lines, dry farming of wheat, in addition to irrigation farming, is being rapidly extended.

The Pacific Power & Light Company furnishes electric light and power service, as well as operating the waterworks system at Pasco. The company is now operating approximately 600 miles of 66,000-volt, three-phase transmission line in central and southern Washington and northern Oregon.

On Dec. 23, 1911, the Mayor issued a proclamation designating that date for a municipal celebration, in order publicly to emphasize the completion of municipal improve-

ments made during the year, the total cost of which has been approximately $600,000. Included in the municipal work is an ornamental cluster post-lighting installation. The afternoon of the holiday was given over to athletic events, open-air vaudeville and similar entertainment.

Two blocks on Lewis Street, which is the main business street of the city, were roped off for the afternoon and evening carnival. In addition to the illumination from the cluster lighting posts, festoons of red, white and blue incandescent lamps were suspended across the street the length of these two blocks, between posts. Flaming arcs at the center of the blocks and a searchlight covering the entire stretch of the carnival scene gave a great brilliancy of illumination.

Fig. 1—Night View of Fourth Street, Pasco, Wash.

During the evening Mayor Gray of Pasco, at the close of an address, opened a control switch at the speakers' stand, leaving the downtown business streets in darkness. When the switch was closed for the second time the new cluster post system and special decorative lighting was turned on for the first time. Addresses were made by Mr. R. J. Andrus, manager of the Pacific Power & Light Company, President Eben White of the Commercial Club and many prominent citizens of Pasco.

Fig. 2—Lamp-Post at Pasco, Wash.

The new lighting applies to ten and one-half blocks of the two principal business streets of the city; as these streets lie at right angles, the district illuminated has the shape of a huge T. The posts installed are of the three-light type as used in the city of Seattle and were cast by the Olympic Foundry Company. Each post is equipped with three 60-watt, 120-volt tungsten lamps, arranged on two circuits, the top lamp of each post being on a separate circuit from the two side lamps. The upper lamp of each post is equipped with a 16-in. Alba globe, the side-lamp Alba globes being 14 in. in diameter. The posts are installed four to a block and symmetrical on the two sides of the street, bringing the posts 130 ft. apart. As the blocks are 400 ft. in length, this places the posts at each street intersection 5 ft. from the property line and results in placing eight posts around the street intersection, affording a very uniform and increased illumination at these points. The posts are fed from a 110-220 volt, three-wire system, which in detail consists of three No. 10 rubber-covered wires, carried in ¾-in. black conduit under the pavement gutter, between posts. The top lamp of each post is on one side and the two side lamps on the other side of the three-wire system. The conduit runs, controlling eight posts, are brought up to iron entrance switch-boxes, located on the wooden poles of the company's distribution system. As all of the distribution is in the alleys, this brings the control boxes at the intersection of the street and alley. The neutral at the control boxes is non-fused, and there is no switch installed on the neutral control, the two circuits being closed on two single-pole fused knife switches.

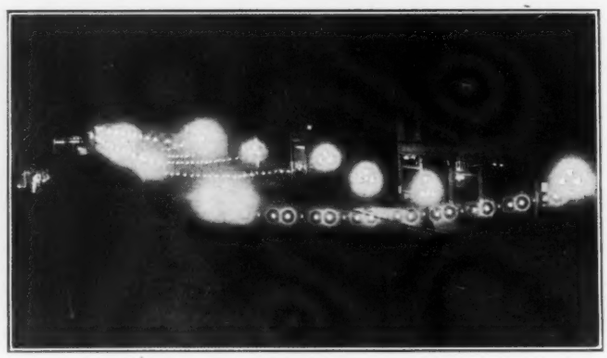


Fig. 3—Festival Illumination at Pasco, Wash.

The cost of the system installed complete, with lamps, globes, controlling switches and boxes, was borne by the city and amounted to approximately $100 per post. The cost of operation and maintenance of system is paid for from the general municipal funds of the city. The installation cost was handled by the creation of a special improvement district, and the cost of installation was assessed against the property directly benefited.

The Pacific Power & Light Company has a five-year contract with the city at a rate of $30 per post per year, which covers electrical energy, renewals and patrol expense. This contract automatically renews itself for an additional five years at a rate of $26 per post per year, unless terminated by the city by written notice within thirty days of the expiration of the contract term. The contract can be renewed at the option of the city at the end of ten years for an additional term of ten years at a rate of $26 per post per year. All lamps on each post burn from dusk until midnight every night in the year, the top lamp burning until dawn. The patrol service is supplied by a messenger boy, who also turns out signs, outlines and flat-rate window-lighting installations, and costs the company $1 per switch box per month. In addition to patrol service, the company provides renewal of lamps and globes and gives the system a regular inspection on Saturday of each week. Upon this inspection, lamps and broken globes are renewed and outer globes cleaned. The company is to paint each post once a year with a good waterproof paint. It is expected that this inspection service will keep the installation in perfect condition and encourage other flat-rate business. The company has for some time been making

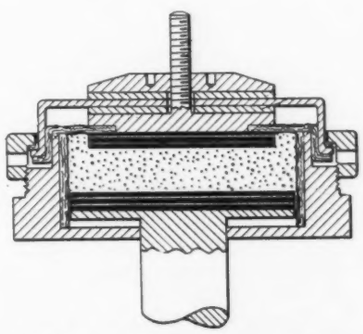
Saturday inspections of flat-rate signs, building outlines and window lighting.

The work of interesting the people of Pasco in a decorative street-lighting system was begun last January. Descriptive literature was sent to all of the councilmen, members of the Commercial Club and business men of the city. A contract was finally secured for an installation of six posts at one of the hotels of the city, the expense of installation and operation being borne by the hotel management. As usual, the first installation created a desire upon the part of all business men to have a similar system cover the downtown streets. The installation of the system and the securing of the contract covering its operation were the result of the efforts of Mr. R. J. Andrus, local manager of the Pacific Power & Light Company. Mr. Andrus has just been successful in interesting the Commercial Club and City Council of Pasco in the erection of a slogan sign. This sign will be erected at the Union Depot, where the cluster post-lighting system begins. "Keep your eye on Pasco" is the text of the slogan, the "eye" alternately opening and shutting.

## RECENT TELEPHONE PATENTS.

### TRANSMITTERS AND APPLIANCES.

The solid-back and similar types of transmitter have usually employed an auxiliary diaphragm of mica. Mr. F. Gottschalk, of New York City, has, however, substituted for the mica a metallic diaphragm as less liable to injury. This diaphragm carries a flange which is engaged by the clamping ring. Insulating material is, however, inserted



Button of Telephone Transmitter.

to prevent direct contact with the ring, and an asbestos or similar washer is inserted to keep the carbon granules out of contact with the diaphragm. The illustration shows the arrangement.

### ANTISEPTIC MOUTHPIECES.

There have been several recent patents for antiseptic devices for transmitter mouthpieces. One of these, the invention of Mr. Charles Adams, of New York City, is a cap of paper or similar material which is so shaped that when placed over the transmitter its flat bottom engages the face of the mouthpiece. A conical part extends back to the transmitter face, where the cylindrical wall of the cap snugly surrounds the transmitter case. Another consists of a cone-shaped piece of sheet-metal construction. This is slipped over the mouthpiece so that its small end engages the lip of the mouthpiece while the base of the cone abuts on the face of the transmitter. The space between the mouthpiece and the cone is filled with antiseptic material. A duct leads from within the mouthpiece to the cone so that fumes may enter the sound passage. This antiseptic device is the invention of Mr. C. E. Rogers, of Waverly, N. Y.

A third type of device invented by Mr. M. M. Marcuse, of Far Rockaway, N. Y., consists of a perforated metal diaphragm which clamps over the lip of the mouthpiece, to which is secured a dished cover within which the antiseptic absorbent is secured. The cover is arranged to swing upon a pin so that it may be turned out of the way when the transmitter is in use.

Mr. I. S. Rosenblatt, of San Francisco, is the patentee of an antiseptic mouthpiece. The body is of glass. A metal threaded portion is set in the base. This also forms a perforated diaphragm. The lip of the glass carries clips which are adapted to receive and hold a second perforated diaphragm. The space between the diaphragms is filled with fibrous material which has been treated with antiseptic solution.

### COMBINED TELEPHONE AND ALARM.

An adaptation of the telephone to a burglar-alarm system has been made by Arthur Köhler, of Chicago. A vibrator and microphone are connected to the circuit. The vibrator is set in motion by tampering with the door. The interrupted current sets a relay and thereby closes the alarm-bell circuit. If a telephone be plugged in on the line the characteristic tone of the vibrator is heard.

In an alarm system invented by Mr. A. E. Paige, of Philadelphia, a vibrator is also used, but in this case the burglar-alarm circuit is connected to a regular telephone line and the vibrator serves to impress a peculiarly variable signal upon the regular line lamp.

# Letter to the Editor

## INTERIOR WIRING COSTS.

*To the Editor of Electrical World:*

SIR:—I read with interest the article on "Standardized Interior Wiring Prices," by Mr. H. L. Parker, appearing in your issue of March 9. I think, however, that the article contains several statements which need further elucidation, as otherwise an entirely wrong impression may be created.

In Table I, which presumably is a schedule for an actual job, no knobs are listed. I also note that the tubes are listed by the foot, but this is probably a typographical error. The most serious fault with that table lies, however, in the fact that no charge is made for overhead expense. It will be readily admitted that, no matter how large a business may be, it costs something to do business. Actual figures as compiled by the National Electrical Contractors' Association show that the actual overhead expense for electrical contractors varies from 45 per cent for a business of $10,000 a year to 20 per cent for a business of over $50,000 a year.

Considering the above figures, it would appear that the actual cost of that particular job is not $45.73, as stated, but at least $12 to $13 more—assuming a contracting business of $40,000 a year. Also, that the 25 per cent listed as profit is incorrect in that the total cost should have been about $58. Adding the same percentage of profit, the cost price to the customer would be about $72 instead of the $57 listed.

I would also like to call attention to a typographical error on page 551, under Job 1. The price per outlet for 69 watts should be $0.057, as listed in Table III, instead of $0.068, as used in the equation to obtain the cost of Job 1. Attention is called to these matters not with any idea of finding fault, but merely to correct any wrong impression that readers may obtain. I desire particularly to emphasize the overhead-expense omission.

LEO DOLKART.

*Moline, Ill.*

# Digest of Current Electrical Literature

ABSTRACTS OF THE IMPORTANT ARTICLES APPEARING IN THE ELECTRICAL PERIODICAL PRESS OF THE WORLD

### Generators, Motors and Transformers.

*Calculation of Self-Induction Coefficients.*—A. Guyan.—A highly mathematical paper in which the author gives formulas for the calculation of certain self-induction coefficients required in the design of single-phase motors. Some approximations of these formulas are also given.—*La Revue Elec.*, March 8, 1912.

*Determining Losses and Efficiency of Small Machines.*—R. Czepek.—For determining the losses and efficiency of a machine the retardation method, while otherwise very reliable and exact, is unsuitable for small machines because the time during which the machine runs to rest is too short. The author shows how the spark recorder may be usefully employed for this purpose and gives a description of the use of this method with diagrams.—*Elek. u. Masch.* (Vienna), Feb. 18, 1912.

### Lamps and Lighting.

*Condensers for Metallic-Filament Lamps.*—An illustrated account of the Helsby system of using condensers in connection with alternating-current lighting installations. The advantages of this system, which has already been noted in the *Digest*, are pointed out. The parallel system is easily applied to houses already wired and can be adopted for any number of single lamps or groups of lamps as may be convenient; and lamps not arranged for control by a condenser would be left to run at their original voltage. The flexibility of the system is such that it can be applied to those points where the greatest saving can be effected, that is to say, where low candle-power lamps are sufficient, without interference with those points where high candle-power lamps, suitable for the full pressure of supply, are necessary. The series system is particularly suitable for application to new installations and extensions to old installations, or to special cases such as a number of lamps on a single fitting. In general, the cost of the condenser is not much more than the saving effected in the first cost, due to the use of low-voltage lamps.—London *Electrician*, March 8, 1912.

*Metallic-Filament Lamps.*—Continuations of the long illustrated serial on recent progress in incandescent-lamp manufacture, chiefly based on German patent specifications. The present instalments relate to the after treatment of the finished filaments and the connections of the filaments among themselves and with the leading-in wires.—*Zeit. f. Beleucht.*, Feb. 10 and 29, 1912.

*Incandescent Lamps.*—P. Le Boeuf.—A review of various recent investigations on various problems of metallic-filament lamps, especially resistance to shock, changes of structure during life, change of resistance during one period in alternating-current operation, the question whether incandescent lamps have a self-induction and the phenomenon of overshooting.—*La Lumière Elec.*, March 2, 1912.

*Manchester.*—Up to the end of last year all the street lighting in Manchester was by gas, the gas being supplied by the municipal gas plant. Two streets are now, however, experimentally lighted with flame-arc lamps. A description of the installation is given.—London *Elec. Eng'ing*, March 7, 1912.

*Photometric Paddle-Wheels.*—A note on a paper by J. R. Milne read before the Royal Society of Edinburgh on a new form of rotating photometric "sector," capable of very accurate adjustment, while running, to any desired light-transmission value, and possessed of the great advantage of having its rotating part in only one piece. The rotating part, which is somewhat similar to a paddle-wheel in appearance, may take various forms. The simplest consists of two flat triangular vanes fixed on the shaft of an electric motor by means of which they are rotated and having their planes not at right angles to the shaft. The motor is fixed to a base which turns on a vertical pivot, the pivot being directly underneath the beam of light. In spinning round, the vanes interrupt the light, and the amount of interception depends on the azimuth of the base, which can be ascertained from a circular scale round its edge. This new type of apparatus is also discussed mathematically, formulas being deduced for the intensities of the light transmitted under different conditions and for the greatest width of the beam of light that can be employed.—London *Electrician*, March 8, 1912.

### Generation, Transmission and Distribution.

*Phenomena in Electric Line on Closing the Circuit.*—R. Rüdenberg.—A mathematical paper discussing the transient phenomena which occur immediately after closing the circuit. He first considers the case where an emf is impressed on a line and the end of this first line is connected through a switch to a second line. The first line is therefore under voltage, but as long as the switch is open the second line is not under voltage. The author shows that when the switch is closed a potential-difference wave is propagated from the switch into the second line and charges it, while at the same time another potential-difference wave travels backward from the switch into the first line and discharges it partially. Such traveling potential waves may damage apparatus or machines, but by means of protective resistances these waves may be greatly diminished in intensity. The best dimensions of such protective resistances are calculated and a simple approximate formula is given. Finally, an example of the wave entering a generator is discussed, and it is shown that in it voltages of double the voltage in the network may occur.—*Elek. u. Masch.* (Vienna), Feb. 25, 1912.

*Flywheel Storage.*—A note on a recent British patent (No. 5620, Feb. 29, 1912) of the British Thomson-Houston Company (General Electric Company of this country). To relieve the load on a generating station where large fluctuations occur a motor driving a flywheel is connected across the mains. The motor-field current is supplied by an exciter generator, which is in turn controlled by a solenoid-operated resistor in its field circuit. The solenoids are connected in the mains supplying energy to the load and the motor respectively. A storage battery may be put across the mains. The resistor, the resistance of which is controlled by the main current, is normally in circuit, and that controlled by the motor current normally short-circuited but put in circuit upon the occurrence of an overload on the motor.—London *Elec. Eng'ing*, March 7, 1912.

*Flywheel and Motor Rating.*—S. A. Fletcher and C. R. Riker.—A discussion of the fundamental principles determining the relation of flywheel and motor rating for industrial loads. The authors give formulas for making calculations of this kind and some useful diagrams, among them a diagram for securing flywheel effect from the dimensions of a flywheel and a diagram for use in determining the load characteristics of a motor driving a flywheel.—*Elec. Journal*, March, 1912.

*Water-Power Plants in Italy.*—E. Giovannoni.—The first part of a statistical article on the development of water-power plants in Italy. The total rating of the Italian electric plants in 1900 was 82,000 hp; in 1905 it was 315,-

500 hp, of which 190,500 hp was generated from water and 125,000 hp from steam. In 1909 the rating was 750,000 hp, of which 510,000 hp was generated from water and 240,000 hp from steam. No definite figures are available for 1910, but since in that year some very large plants were opened, the total rating should now be above 1,000,000 hp. Statistical data are given on water-power developments in different districts of Italy. The article is to be concluded. —*Elek. Zeit.*, March 7, 1912.

*Winnipeg.*—The conclusion of the illustrated description of the hydroelectric system of the city of Winnipeg. In the present instalment a description is given of the turbines and electrical plant, transmission line, transformer station, and distribution network.—London *Electrician*, March 8, 1912.

*Boiler Plants.*—J. GUILLAUME AND A. TURIN.—The concluding part of their long illustrated paper on boiler plants. In the present instalment the authors deal with the pipe-line construction and the general arrangement of the plant. —*La Revue Elec.*, March 8, 1912.

*Briquetting Plant.*—An illustrated article on the use of electric power for briquetting plants in metallurgical works. —London *Elec. Review*, March 8, 1912.

### Traction.

*Single-Phase Locomotives.*—H. BEHN-ESCHENBURG.—An illustrated article on the new 2500-hp single-phase locomotives built by the Oerlikon Company for the Berne-Loetschberg-Simplon line. The 1250-hp single-phase motors employed on these locomotives weigh, together with the gear drive, 14 tons. The author considers the series motor to be the only suitable type for single-phase traction, as its speed is not limited. The method of compensation employed by the Oerlikon Company is very satisfactory, the commutation is excellent, and in fact is as good as on a direct-current motor. Some details are given of the design of the control apparatus, which offers various novel features.—*Elek. Zeit.*, March 7, 1912.

*Current Collection on Electric Railways.*—G. L'HOEST.—An illustrated paper on third-rail construction and various single-trolley and double-trolley wire designs.—*L'Electricien*, Feb. 17, 1912.

### Installations, Systems and Appliances.

*Limiting Device for Flat Rate.*—BREITLAENDER.—An illustrated description of a very simple limiting device for use in connection with installations in which a flat rate is used and a maximum power consumption is agreed upon. As soon as the consumer tries to take more current than is agreed upon a solenoid operating an interrupter breaks the circuit 120 times a minute, so that the light flickers seriously and the consumer is forced to decrease the amount of current consumed. The device has proved very satisfactory in commercial practice over an extended period.—*Elek. Zeit.*, March 7, 1912.

*Rate Making.*—W. W. LACKIE.—The first part of a paper read before the (British) Institution of Electrical Engineers on rates for electrical energy, with particular reference to domestic rates and to the methods by which domestic consumers have been encouraged in Glasgow.—London *Electrician*, March 8, 1912.

*Electric Heating Apparatus.*—MARCHAND.—An illustrated article on numerous electric cooking and heating apparatus of British make.—*L'Electricien*, Feb. 10, 1912.

### Wires, Wiring and Conduits.

*Wiring of a Chemical Factory.*—Some suggestions on the best arrangements of the lighting and wiring installation in a chemical factory, with estimates of the cost of maintenance.—London *Elec. Eng'ing*, March 7, 1912.

### Electrophysics and Magnetism.

*Ionization by Collision.*—N. CAMPBELL.—An investigation in which the physical assumptions made in Townsend's theory of ionization by collision are analyzed and discussed. It is pointed out that one of them is to the effect that the negative ion does not undergo any permanent change in its properties as a consequence of repeated collisions with neutral molecules. This assumption is contradictory to the other view of ionization by collision, according to which the negative ion, when first formed, is an electron, but subsequently becomes a "complex ion" by gathering round it neutral molecules. Townsend's mathematical argument, by which he applies these assumptions to certain cases of the discharge through gases, is sketched briefly. It is pointed out that this argument contains an error. No attempt is made to arrive at completely accurate formulas, but a nearer approximation is made. The new formulas are applied to Townsend's measurements and shown to agree with them better than those which he used. Similar formulas are briefly sketched based on the older view that a negative ion after collisions with neutral molecules becomes a complex ion. Townsend's experiments are not so well suited for distinguishing between the two theories. A further paper is promised.—*Philosoph. Mag.*, March, 1912.

### Electrochemistry and Batteries.

*Rapid Formation of Storage-Battery Plates.*—G. SCHLEICHER.—A long account of experiments on the rapid formation of lead storage-battery plates, with special reference to the use of sodium perchlorate as an accelerating agent.—*Zeit. f. Elektrochemie*, July 15, 1911; *La Revue Elec.*, March 8, 1912.

### Units, Measurements and Instruments.

*Properties of Dielectrics in Alternating Fields.*—G. L. ADDENBROOKE.—The author first investigates theoretically how a dielectric would behave with varying frequency if it

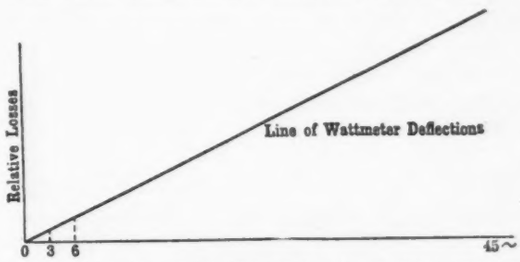



Fig. 1—Experimental Curve for Dielectric of High Resistance. Losses at Different Frequencies.

was equivalent to resistances and capacities in series or to resistances and capacities in parallel. From the results which he has obtained he concludes that neither of these suppositions seems to agree with the real actions occurring as found experimentally. His investigations were made with frequencies varying from 1 cycle in four seconds up to 45 cycles per second with constant maximum voltage. With good dielectrics (such as gutta percha, crown glass, etc.) it appears that the loss per cycle tends to a constant with a given strength of field over a wide range of frequency, and the rate of loss varies substantially directly as the frequency (Fig. 1). With liquids the loss, if the

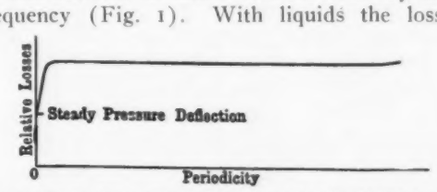



Fig. 2—Curve from Experiments with Liquid Dielectrics.

liquids are not freed from moisture, tends to be nearly constant and to be almost entirely independent of the number of cycles, or the loss per cycle is nearly inversely proportional to the number of cycles, the action in this respect being the same as for currents flowing in metallic conductors (Fig. 2). With inferior dielectrics (such as cellu-

loid) the action seems to be intermediate between the above two actions and possibly to be made up of two separate actions of the above characters acting independently but each contributing its quota to the energy loss.—London *Electrician*, March 1, 1912.

*Magnetic Tests.*—Jouaust.—An abstract of a paper presented before the International Society of Electricians in Paris giving an account of comparative magnetic tests of various steels made with different methods of testing. For carbon steels with 0.29 to 0.35 per cent carbon the same results are obtained with the Picon permeameter as with the ballistic method using a ring sample. However, for certain soft steels the curves of the induction as a function of the magnetizing force differ somewhat for the two methods. The reason for the discrepancy is believed to be magnetic viscosity. Tests with sheets show that the induction in direction of the laminations is greater for the same magnetizing force than in a direction perpendicular to the laminations; however, with a ring sample the results are identical. For very high-frequency alternating-current tests (the frequency being of the order of 1000 cycles per second) the permeability is not very different from that for direct current. The induced currents must, however, be taken into account.—*L'Industrie Elec.*, Feb. 25, 1912.

*A Balance Method for Determining Quantities of Radium.*—E. Rutherford and J. Chadwick.—An abstract of a paper read before the (British) Physical Society. A balance method is described for accurately comparing quantities of radium by their gamma radiation, in which the ionization due to the gamma rays is balanced against the constant ionization due to uranium oxide. By observing the distance of the radium preparation from the ionization chamber when a balance is obtained, the relative gamma-ray activities of the two preparations can be determined with an error not exceeding one part in 400. The balance method was employed to determine the period of transformation of the radium emanation. The half-value period was found to be 3.854 days. It was found experimentally that the gamma-ray activity due to the radium emanation and its products reaches a maximum 255 minutes after the introduction of the emanation into a sealed tube. Calculations showed that under the experimental conditions the theoretical maximum should be reached after 255 minutes. It was found that the gamma-ray activity of a radium preparation was not appreciably altered by exposure in a strong magnetic field.—London *Electrician*, March 8, 1912.

*Suitable Wire Sizes for High-Frequency Resistors.*—L. W. Austin.—In connection with high-frequency testing the accompanying table of wire sizes is of importance, for which the high-frequency resistance will be less than 1 per cent greater than direct-current resistance.

WIRE SIZES FOR HIGH-FREQUENCY RESISTORS.

| Wave Length. | Constantan or advance wire. | | Manganin Diameter. | Platinum Diameter. | Copper Diameter. |
|---|---|---|---|---|---|
| | Diameter. | Maximum Current. | | | |
| *m.* | *mm.* | *amp.* | *mm.* | *mm.* | *mm.* |
| 100 | 0.30 | 3.5 | 0.29 | 0.13 | 0.006 |
| 200 | 0.46 | 4.5 | 0.40 | 0.20 | 0.045 |
| 300 | 0.57 | 5.5 | 0.50 | 0.27 | 0.09 |
| 400 | 0.66 | 7.0 | 0.60 | 0.30 | 0.10 |
| 600 | 0.83 | 8.0 | 0.75 | 0.37 | 0.15 |
| 800 | 0.98 | 10.0 | 0.88 | 0.42 | 0.20 |
| 1000 | 1.10 | 11.5 | 0.99 | 0.50 | 0.21 |
| 1200 | 1.20 | 12.5 | 1.10 | 0.57 | 0.22 |
| 1500 | 1.30 | 14.0 | 1.21 | 0.63 | 0.26 |
| 2000 | 1.52 | 17.0 | 1.38 | 0.73 | 0.30 |
| 3000 | 1.80 | 24.0 | 1.62 | 0.80 | 0.33 |

Doubling the diameter given in the table will produce a difference between direct and high-frequency resistance of approximately 10 per cent, while one-half the diameter given in the table will reduce the difference to approximately 0.1 per cent.—*Journal Washington Acad. of Sciences*, March 4, 1912.

*Quadrant Electrometer.*—A. Anderson.—A mathematical theory of the behavior of the quadrant electrometer, which has the merit of simplicity and may be applied in the use of the instrument.—*Philosophical Mag.*, March, 1912.

*Measuring Iron Losses.*—Angermann.—An illustrated article describing an arrangement of apparatus which permits the immediate comparison of the losses of a sample of sheet iron in the Epstein apparatus with a standard bundle previously calibrated once for all. There are no calculations necessary, and the method is so simple that it can be carried out by an ordinary workman. The method is, therefore, suitable for the continuous control of the sheet iron furnished from the steel works.—*Elek. Zeit.*, March 7, 1912.

### Telegraphy, Telephony and Signals.

*Microphone for Strong Currents.*—C. Egner and J. G. Holström.—The first part of an account of their researches begun in 1907 on the construction of a microphone for strong currents. Such an instrument serves two purposes, as it is suitable for wireless telephony as well as for telephone transmission over very long lines. The construction is different in the two cases, but the principle is the same. The authors first describe the arrangement of their experiments in which they tested systematically the different factors that have an important influence on the efficiency of a microphone. The pressure between the contact surfaces is very important. Beginning with very small pressures the sound was accompanied by a disturbing noise due to small arcs between the contacts; by gradually raising the pressure this parasitic noise was gradually diminished and finally stopped entirely, when the sound was very strong and indeed a maximum; by increasing the pressure still more the density of the sound was gradually diminished but simultaneously the articulation became more distinct. In order to get a fully satisfactory articulation and a constant effect, part of the maximum intensity of the sound must be sacrificed. The width of the microphone cell—that is, the area of the contact surface between electrode and carbon granules—has no effect on the microphone resistance. The intensity of the current influences the microphone resistance greatly since the resistance decreases when the current is increased in such a way that the microphone voltage seems to have a constant value. Carbon seems a better material than metals for the contacts. Different kinds of carbon give very different results. On the other hand, the condition of the surface of the carbon electrode, whether polished or rough, seems to have no effect. The microphone was tested with various gases in the carbon cell. Only hydrogen, and to a certain extent illuminating gas, improved the results. The use of hydrogen has the advantage that the microphone can be operated at a higher voltage so that the microphone resistance also becomes greater. This resistance is increased by between 30 and 40 per cent, and the variations of the resistance are increased in about the same degree. However, the employment of hydrogen complicates the use of the construction of the microphone, but this would be of less importance for large wireless telephone stations. Another very important factor is the temperature in the carbon cell, cooling being very beneficial. Several arrangements with water cooling were tried. An arrangement is described which was used by the authors in practice in which the diaphragm is horizontal and below the carbon cell and separated from it by means of a layer of mica. Since the heat produced in the carbon cell rises upward it does not pass over to the diaphragm below. Above the carbon cell is a vessel filled with water, and the heat given off from the carbon cell passes into the water and is carried away by the water currents caused by the temperature differences. A microphone of this type was operated from a 220-volt lighting circuit, an arrangement for providing a constant current being described. In this case the current supplied to the microphone is some-

what more than 1 amp and the microphone emf is 8 volts. A voltmeter connected to the microphone shows strong deflections on speaking into the microphone. For instance, the vowel "a" strongly spoken into the microphone raises the emf to 12 or 16 volts. With this instrument the authors succeeded in June, 1909, in telephoning over the lines from

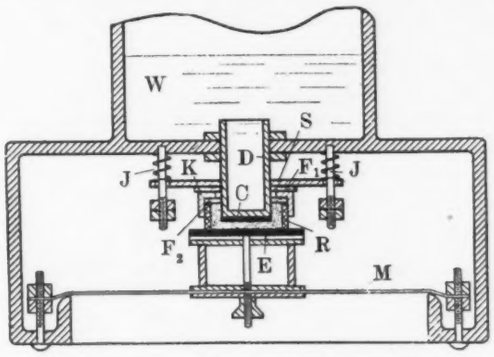



Fig. 3—Microphone for Long-Distance Transmission.

Berlin to Stockholm, from Paris to Stockholm, and from Paris to Sundsvall (2850 km, or 1710 miles, including 48 km, or 29 miles, of cable).—*Elek. Zeit.*, Feb. 29, 1912.

The conclusion of their article on the design of a microphone suitable for operation with strong currents for long-distance transmission. The arrangement of a microphone in the form of several microphones in series in one apparatus has been found particularly useful. It is necessary that the diaphragms in the different cells vibrate always in time-phase and with the same amplitude. This is accomplished by connecting the diaphragms and electrodes (in contact with the carbon granules) solidly together, so that they are forced to oscillate in unison together. The construction is shown in Fig. 3. The stationary electrode *D*, consisting of copper, is hollow and filled with a cooling liquid from the container *W*. The contact surface *C* of thin carbon makes contact with the carbon granules. Two tight-fitting felt rings $F_1$ and $F_2$ surround the electrode *D*. One of them is within and the other is below an annular aluminum dish *K* in which a ring *R* of asbestos is placed. This ring *R* forms the side wall of the carbon cell and makes contact with the diaphragm electrode *E*. The real diaphragm is *M*, and the solid connection between *M* and *R* which insures uniformity of vibration as mentioned above

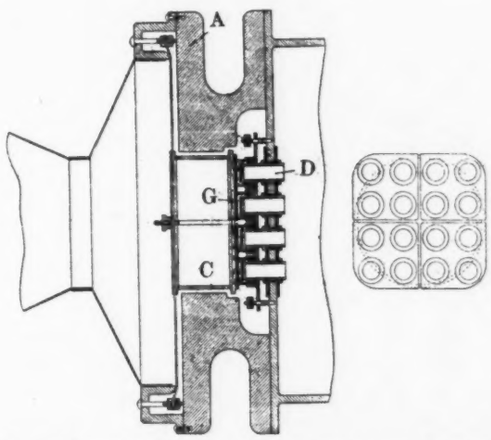



Fig. 4—Microphone with Sixteen Stationary Electrodes.

is clearly shown in the illustration. Each of the carbon cells is thus surrounded by a ring-formed dish, and all these rest on the common plate *S*, which is pressed by means of the springs *J* against the diaphragm electrode so that all carbon cells are closed. In order to avoid the necessity of adjusting the pressure in the different carbon cells the diaphragm is placed vertically and the size of the carbon granules is carefully chosen. Fig. 4 shows a microphone with sixteen stationary electrodes, all of which are hollow and in communication with the cooling liquid container. In this case oil is used. The diaphragm electrode is divided into four electrodes insulated from each other, and to each of these four electrodes correspond four of the stationary electrodes. Thus there are four groups of carbon cells, and the arrangement is so made that in each group two cells are connected in series and two in parallel. Each group is connected by wires with two binding posts. By changing the connections between these binding posts the following combinations can be obtained: First, eight cells in parallel and two in series (emf 10 to 15 volts, current 20 amp); second, four cells in shunt and four in series (emf 20 to 30 volts, current 10 amp); third, two cells in shunt and eight in series (emf 40 to 60 volts, current 5 amp). This microphone is therefore operated by from 200 to 300 watts. Another design of a long-distance microphone, involving the same fundamental principles, is also described. In telephony satisfactory sound transmission is possible as long as the intensity of the current at the receiving end is about one-thirtieth the current at the transmitting end. The greatest distance in ordinary telephony with a 3-mm copper line is about 1000 km (600 miles). If it is intended to double the distance of transmission, the microphone must produce currents thirty times as strong as the ordinary microphone. This indicates clearly the limitations of this method. In the commercial microphone developed by the authors the intention has been to increase the distance of transmission by only 70 per cent. In this way it has been possible to design robust instruments. These are now in commercial use in Sweden, and sixty-four subscribers have adopted them. It is expected that their use will increase largely as soon as other countries near Sweden also adopt them.—*Elek. Zeit.*, March 7, 1912.

*Theory of the Submarine Telegraph Cable.*—H. W. MALCOLM.—An illustrated mathematical article in which a short account is given of the work of Lord Kelvin by which he was led to the discovery of the "*KR*" law and to the first and most simple form of arrival curve. The shape of the arrival curve is dependent on the signaling apparatus; and to obtain the curve under practical conditions the apparatus must be taken into account. After a discussion of the general theory of the propagation of signals in cables, a method is developed for obtaining arrival and sending curves by simple calculation for any form of apparatus. The method is illustrated by many examples and is applied to derive the theory of the use of apparatus, such as arrangements of resistances and condensers, inductive shunts and artificial leaks, and to show the influence which they exert on the shape of the arrival curve and, therefore, on the maximum speed of signaling. The results are expressed in practical units and are contained in tables, and they are applicable to cables of any type. In conclusion, illustrations are given of the use of arrival curves to build up a message at different rates of sending, whereby the influence of the apparatus can be rendered evident.—London *Electrician*, March 8, 1912.

*Directive Wireless Telegraphy.*—F. KIEBITZ.—An illustrated description of his recent experiments on directive wireless with earth antennas. The arrangement of the experiments and the results are described in detail. Probably the most interesting result is that the aerial conductor systems which are employed in wireless telegraphy and which are now carried by towers and masts can in all cases be replaced by horizontal antennas where the use of horizontal conductors is a constructional possibility. For such installations it is of small importance whether the wires are laid beneath the earth's surface or are carried a little distance above it, or whether earth connections are used or not. To secure good effects with the horizontal antenna the only condition of fundamental importance besides as great a length as possible is that there should be maximum potential at the extreme ends and, so far as possible, maximum cur-

rent at the middle. A straight conductor of length equal to half a wave length and having insulated ends, laid just above the ground or in trenches, could therefore be looked upon as being the most favorable shape for an earth antenna. The wave length appears to be shortened by the proximity of the earth.—London *Electrician*, March 8, 1912.

*Wireless Telegraphy.*—L. W. Austin.—An account of an experiment in which the author investigated whether the ground absorptions of damped and undamped oscillations differ from each other, other conditions being the same. From the experiments made the conclusion is drawn that the absorption of the energy of the waves in passing over the country in question is the same in the case of the undamped and moderately damped oscillations within the limits of the errors of observation.—*Journal of Washington Academy of Sciences*, March 4, 1912.

**Miscellaneous.**

*Turin Exhibition.*—An illustrated description of the electrical exhibits at the Turin exhibition in 1911. In the power house various large Diesel engines of from 1000 to 1200 hp were noteworthy, besides some steam turbines. In the electrical section Germany, Switzerland, Austria and Hungary were especially well represented. The traction section was also quite representative. A particular feature of the exhibition was a special hall in which experimental demonstrations were carried out under the direction of Professor Arno. Among them was the Righi apparatus for showing the similarity between light and electromagnetic waves; a Moore tube-lamp installation; the system of Korn for electrically transmitting pictures by means of selenium cells; the Pauling process of a fixation of nitrogen; experiments with the singing arc, etc.—*Elek. Zeit.*, March 7, 1912.

*Copper Castings.*—A note on a recent British patent (No. 12,920, Feb. 29, 1912) of the British Thomson-Houston Company (General Electric Company of this country). As described in specification No. 25,031, 1910, a small percentage of boron or a boron compound is added to the molten metal, but in this case, instead of pouring the molten copper at about 1100 deg. C., the temperature of the copper is raised to about 1350 deg. C., when boron suboxide or carbide is placed in a heated crucible and the copper is poured thereon, being well stirred during the process. When this process has been completed a layer of charcoal is put on, and the whole is allowed to cool to 1100 deg. C., when it can be poured into the casting mold. Sound castings of high conductivity are produced.—London *Elec. Eng'ing*, March 7, 1912.

# Book Reviews

The Progress of Physics. 1875-1908. By Arthur Schuster. Cambridge: The University Press. 159 pages, illus. Price, $1.25.

To those who have not followed closely the progress in physics in recent years, and particularly the revolutionary advances associated with the development of the electronic theory and radioactivity, this little work will be of the highest interest. And even those who have not neglected to take note of current progress will find here an account in readable language and within small compass of what otherwise is only contained in special books, difficult to read, or in the proceedings of learned societies. Perhaps a better title for the book would be "The Birth and Growth of Electrophysics," for electrical principles are at the basis of the theories treated, which comprehend chemistry at one extreme and terrestrial and cosmic phenomena at the other extreme.

It is well that this survey should come from the pen of one who has been a leader in formulating the new ideas which have so startlingly shaken the former fundamental bases of physical and chemical science. To the author is largely due the development of the ionic theory, subsequently extended by Sir J. J. Thomson in his corpuscular theory, and later serving as a basis for the theory of radioactivity. The book is a reprint, with some additions, of four lectures designed to give a historical account of the sequence of great discoveries in physical science which have rendered the past thirty years an epoch in scientific progress comparable with the century of Galileo, Huyghens and Newton. The author can be easily followed by the reader of ordinary education, as technical detail has been carefully avoided.

The interest of the book is enhanced by many personal allusions to the great figures in physical science during the period covered, such as Maxwell, Helmholtz, Kirchhoff, J. J. Thomson and others. Professor Schuster was a pupil of Maxwell and gave the first systematic course of lectures on his theories, one of his three auditors being J. J. Thomson. A brief, easily read outline is given of Maxwell's theory of the electromagnetic field and of its consequences, and several anecdotes are related which bring out points in the personality of the great master. In a reference to wireless telegraphy, the author says he insists that as a scientific principle the invention has taught us nothing of conspicuous novelty, and that, though historically arising out of the investigation of electric waves, it involves no scientific facts which were not known to Faraday. "The man who looks upon his 'wire' as a commonplace phenomenon while he considers his 'marconigram' an almost supernatural message is not far removed in scientific education from the old woman who hung a pair of boots on a telegraph wire, so that they should reach her son more quickly than if they were sent by parcel post."

The scope of the contents following the consideration of the work of Maxwell and Hertz may be surmised from some of the subject heads, as follows: Molecules of electricity; cathode rays; conduction through gases; electron theory; ions and ionization; atomic change; Thomson's corpuscular theory; Röntgen rays; Becquerel rays; radium; decay of the atom; electric inertia; nature of the atom; dissipation of energy; variability of the mass; Michelson-Morley ether experiment; principle of relativity; terrestrial magnetism; magnetic storms; atmospheric electricity; age of the earth; rigidity of the earth; identity of atoms; gravitation. In view of the recent publication by Dr. Crehore of an explanation of the cause of gravitation, the following comment on that subject by Professor Schuster is interesting:

"As regards the mystery of gravitation, we have long given it up as a hopeless object to worry about. . . . It stands at present all disconnected from all other forces. Experiments were made by Michael Faraday, than whom no one was better qualified, with the object of finding some relation between gravitation and other effects of nature, but without result. Many theories, no doubt, have been proposed, and one, that of Lesage, received some support, until Maxwell showed it to be untenable. It may be revived some day in a less vulnerable form, but for the present we may disregard it."

---

Direct and Alternating Current Manual. By Frederick Bedell. New York: D. Van Nostrand Company. 349 pages, illus. Price, $2.

This is the second and enlarged edition of a well-known textbook on the laboratory testing of electrical machinery. The book is very clearly written and is excellently adapted for the use of students in engineering laboratories. An excellent appendix is given on harmonic analysis of alternating-current waves. The book will be of particular service to teachers of electrical engineering in connection with laboratory exercises.

# New Apparatus and Appliances

## DIMMER FOR PITTSBURGH THEATER.

The dimmer illustrated herewith was developed for use in theaters, the particular equipment shown being installed in the Harris Theater, Pittsburgh. The dimmer bank consists of sixty standard dimmer plates, and these with the frame, exclusive of the slate, switchboard panels and switch parts,

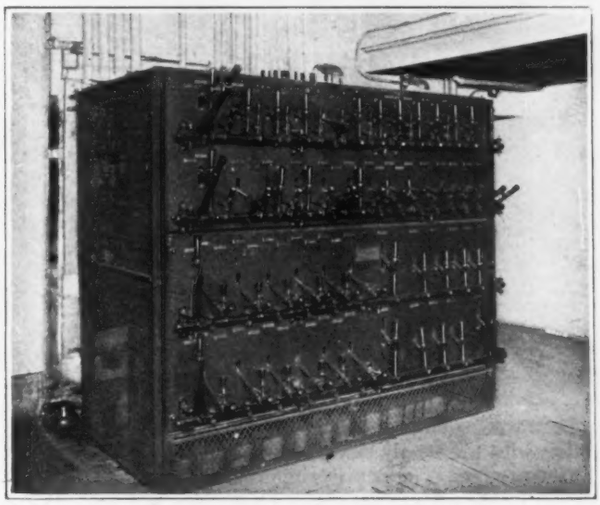


Fig. 1—Front View of Dimmer Equipment, Showing Rheostat-Controlling Devices.

weigh 3600 lb. The plates are arranged in four rows and mounted in a substantial wrought-iron frame. This frame is erected behind and on the floor below the dimmer switchboard, standing about 5 ft. off the floor. The plates are operated by rack rods from pinions on the individual dimmer shafts to bell cranks mounted behind the dimmer switchboard. These bell cranks in turn are operated by the

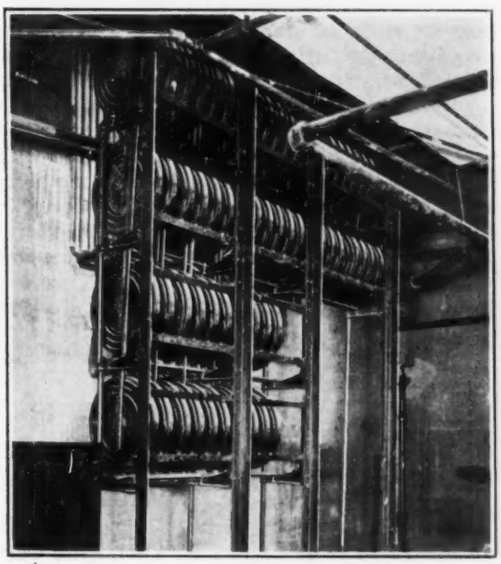


Fig. 2—Rear View of Dimmer Equipment, Showing Rheostat.

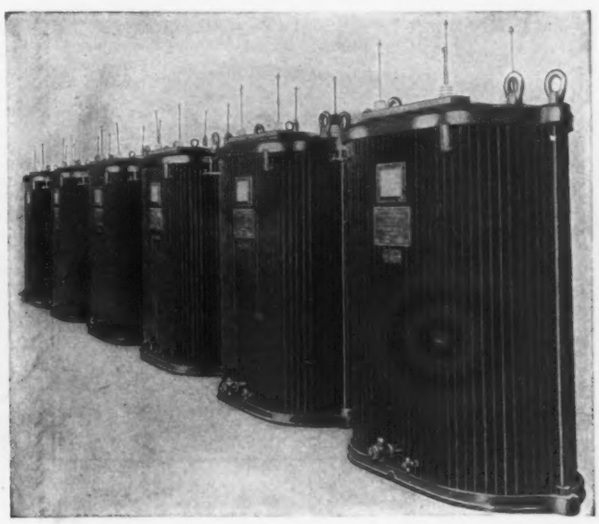
individual and master levers mounted on the face of the switchboard, which latter was manufactured by the Mutual Electric & Machine Company, Wheeling, W. Va. All the graduations in lighting brilliancy for the various scenic effects, in addition to the two fundamental requisites of convenience and noiseless operation, can be obtained by the stage electrician. Each plate is a unit in itself, requires little space, is easily stacked and has a large number of steps so that the dimming and brightening of the lamps is gradual. The unit is moisture-proof and fireproof, the base being soapstone and a special cement being used to cover all the resistance material. A metal cover is placed over all but the contact segment portion.

The dimmer was built by the Cutler-Hammer Manufacturing Company, Milwaukee, and was erected by the Loughridge Engineering & Construction Company, of Pittsburgh.

## TRANSFORMERS FOR CHICAGO STREET LIGHTING.

One of the most important street-lighting undertakings in this country is that embraced in the new plans for lighting the streets of Chicago, and the most modern type of equipment is being installed. Power will be supplied from the Sanitary District power house located at Lockport, Ill., on the well-known Chicago Drainage Canal. Power is transmitted over a 44,000-volt, three-phase, 60-cycle line to the main terminal station in Chicago and stepped down to 12,000 volts, at which potential it is transmitted to the substations located in various parts of the city.

The type of transformer employed in substations is shown in the accompanying illustration, a total of twenty-eight being supplied by the Delta-Star Electric Company of Chicago, general Western agents for the Pittsburgh Transformer Company. Each transformer is rated at 250 kva and is of the oil-cooled type, having a primary of 12,000 volts with taps at 11,500-11,000-10,500. The secondary has a normal voltage of 5050 with taps at 4650-4250. The efficiencies come well within modern requirements, being 98.5 per cent at full load, 98.3 per cent at half load and 97.5 per cent at quarter load. The temperature rise is 35 deg. at full-load operation for twenty-four hours and is less than



Type of Transformers for Sanitary District Power House.

40 deg. after two hours' run at 125 per cent load immediately following the full-load run. The design is also such that the transformers will withstand a 200 per cent load for two hours without injury.

The transformers are of the standard Pittsburgh mill

type construction employing thermo-vacuum impregnated coils with adequate spacings between high and low tension. The insulation between primary and secondary windings and between primary winding and core withstands a breakdown test of 34,100 volts, the insulation between secondary windings and core withstanding a test of 12,000 volts. The design is such that a comparatively high reactance is secured, which is desirable in limiting the amount of current rush under short-circuit conditions, a desirable feature which is now generally recognized by operating engineers.

The tanks are of the welded type, this welding being carried out in every detail in mounting the thermometers, valve and oil-gage outlets, etc., thus insuring an absolutely oil-tight structure. The leads are provided with metal unions for making connections to insulated copper tubing, permitting a neat and workmanlike installation.

## WATTMETER FOR MEASURING DIELECTRIC LOSSES.

The increasing use of underground cables for high-tension transmission brings the question of dielectric losses into prominence and makes the measurement of such losses of considerable importance. Makers undertaking the manufacture of high-tension cables must be able to determine the losses with fair accuracy in order to give the guarantees required by purchasers. In the accompanying illustrations is shown a wattmeter built for testing cables at 30,000 volts. The wattmeter is of the Duddell-Mather zero dynamometer type and the main features are: An entire absence of unlaminated metal in proximity to the moving coils, in which eddy currents might be induced; series coils of fine insulated wire stranded together and subdivided into ten equal sections; astatic shunt coils of low inductance capable of carrying continuously twelve times the current necessary to give a full deflection (360 deg.) with unity power-factor.

Use is made of a plug board on which the sections of the series coils may be connected in series, in parallel or in series-parallel, thus giving a wide range of current. For example, with a 50-amp instrument a full deflection can be obtained by currents from 0.5 to 50 amp by suitably ar-

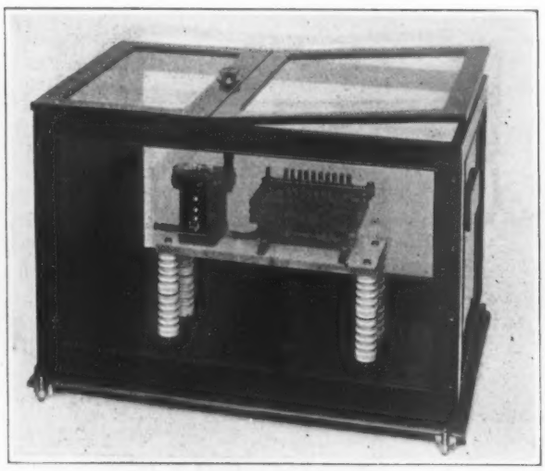


Fig. 1—Wattmeter for Measuring Dielectric Loss.

ranging the sections of the series coils and the resistance of the shunt circuit.

The resistor inserted in the shunt circuit consists of Duddell-Mather anti-capacity non-inductive gauze, by means of which the current in the shunt circuit is kept in time-phase with the voltage on the circuit, a matter of great importance when dynamometer wattmeters are used for loads at very low power-factor. A set of these resistors renders the instrument suitable for a wide range of pressure.

When a wattmeter is used on high-pressure circuits such as 30,000 volts, electrostatic attractions and repulsions become appreciable, and hence precautions must be taken to screen the instrument from such disturbing forces and also to insure safety of the experimenter from shock. These desiderata are secured by inclosing the wattmeter and plug

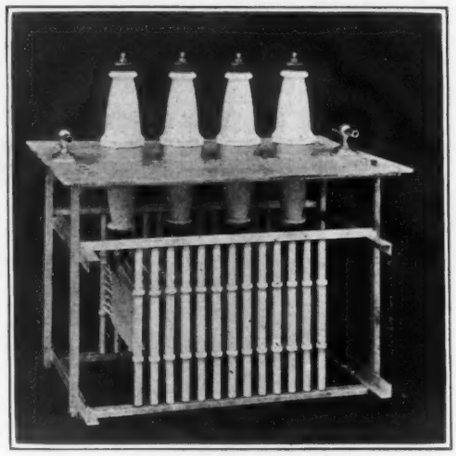


Fig. 2—"Anti-Capacity" Gauze.

board in a wooden box lined with tin foil in electrical connection with the supply side of the instrument, thus forming a Faraday cage. The box is supported on long porcelain insulators inside a large case with glass sides and top. Windows are provided in the inner box, through which the pointer and index may be observed.

The torsion head is operated from the outside of the case by a milled head on an ebonite rod about 10 in. long. This rod passes through a brass bush in the top of the case, which is earthed when the instrument is in use. The lower end of the rod turns an ebonite pinion which gears into a wheel cut on the ebonite torsion head. From these particulars it will be understood that there is little risk of shock in using the instrument and that the moving portions are effectively screened from electrostatic forces.

The non-inductive resistor used in series with the pressure coils of each wattmeter has a total resistance of 300,000 ohms and will carry one-tenth of an ampere. It is contained in two galvanized iron tanks filled with oil. The anti-capacity gauze is carried on porcelain rods supported by a framework from the lid of the tank. Connection with the gauze is made by metal rods passing through long porcelain insulators projecting well above the cover, while the lower ends dip into the oil when placed in the tank. There is a minimum distance of about 6 in. between any live metal and the sides of the tank in order that the tank may be earthed while the gauze is connected with the 30,000-volt supply system.

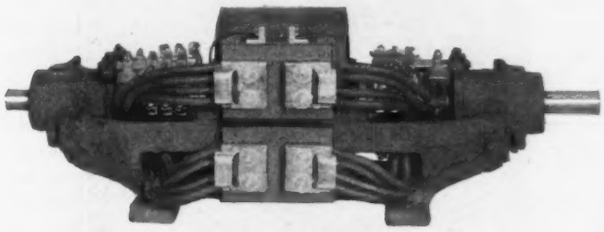
The above described wattmeter has been developed by Robert W. Paul, who has recently opened an office at 1 East Forty-first Street, New York.

## ELECTROLYTIC GENERATORS.

The standard type of generators for electrolytic work, as offered by the General Electric Company, are four-pole machines built in five sizes: 1.5 kw, 3 kw, 5 kw, 10 kw and 15 kw. They run at the standard speed so that they may be direct-driven by induction motors where alternating current at 60 cycles is available, if so desired.

Thorough ventilation of the armature insures cool running. Fan blades fastened to the armature heads, in con-

nection with air ducts leading from the center of the core to the circumference, provide adequate ventilation of all parts. The bar windings, which are insulated carefully and connected at the end by copper ribbons, are inserted in insulated slots so that in case of accident to one or more bars they can be easily removed without disturbing the remainder of the winding. All connections between the armature winding and the commutator are soldered to in-



Electrolytic Generator.

sure that there will be no loose connections and consequent sparking at the brushes. The field coils are wound on forms which permits their easy and quick removal from the poles in case of accident.

One line of generators is for one voltage only, and consequently these have but one commutator. They are self-excited generators and will give potentials of from 2 volts to 6 volts at 250 amp and 500 amp, the voltage regulation being accomplished by varying the field. Another line comprises double-commutator-design machines, the armature having two distinct windings, one being connected to each commutator. The terminals may be connected so that the two windings will be in series or in multiple, giving a potential equal to the sum of their voltages and the current equal to that generated by one, or a potential equal to that of one winding and a current equal to the sum of the currents from the two windings. The generator may also take the place of two generators, each winding serving as a separate machine.

## THE MAXICATOR.

A new instrument which is a combination of a maximum-demand indicator and a watt-hour-meter register, taking the place of the original register on the watt-hour meter, is made by the Chicago Electric Meter Company, and is known by the trade name "maxicator." The device, which is illustrated herewith (Fig. 1), has four dials similar to those of watt-hour-meter registers, from which is obtained the reading of total consumption of energy. In addition it is equipped with a large centrally pivoted pointer which indicates on a scale on the margin of the dial plate the maximum demand during a half-hour interval over any period of time, such, for instance, as a week or a month. This larger hand is a friction pointer, the friction being obtained by means of a leaf spring bearing against the shaft. It is carried forward by means of a driving "set-back" pointer connected directly by gearing with the register movement. This set-back element is controlled by means of a solenoid mounted on the back of the register, as shown in Fig. 2, and connected to the gearing through a rack and pinion. The solenoid is energized from the line by means of the small contact-making motor shown in Fig. 3. It drives the plunger up to its seated position and revolves the driving pointer to zero. By means of gravity and the use of the escapement principle the excessive friction, which has been a disadvantage heretofore in devices of this character, has been eliminated in the maxicator. To prevent this additional load being imposed on the meter the plunger of the solenoid, which is raised at the end of each thirty-minute interval to set back the driving element to zero, descends during the next succeeding interval, thus furnishing the power necessary to drive the entire register movement, the meter acting only as an escapement in regulating the speed of falling.

Always the indicating pointer will remain in the position to which it is carried until a higher reading is obtained during the subsequent half-hour interval, the driving element alone being set back, thus leaving the indicating hand at the highest point reached during the week or month. At the end of any period for which the maximum is desired the indicating hand may be set back to zero by unsealing a thumb-nut which is provided in the meter case. This operation should be performed by the meter reader. A complete installation of the maxicator includes one maxicator and one contact-making motor, the latter being shown in Fig. 3. These two parts constitute the complete maxicator. The motor is of the single-phase, 220-volt self-starting induction type and is operated at practically no load, thus giving a uniform speed at all times. Through a train of reduction gearing the speed is obtained upon the last spindle of one revolution every thirty minutes, the contact element being directly connected to this spindle. A motor of this type will run continuously without requiring attention for about two years.

The maxicator is for use with a time interval of thirty minutes, and it is not applicable to any other interval. It is intended to be a comparatively inexpensive instrument to be used in obtaining the maximum demands of customers having a load of 50 hp or less where the income from the customer will not warrant the use of an instrument giving fuller data but at a greater first cost. The maxicator has so far been developed for use with polyphase watt-hour meters of the General Electric type D S-3, Fort Wayne type K and Westinghouse type C (service).

Fig. 1—Front View of Maxicator.

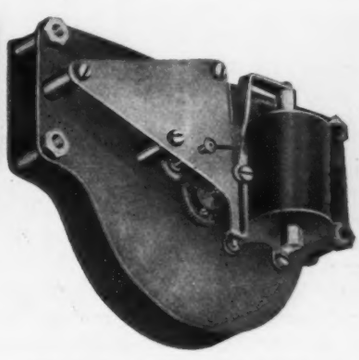


Fig. 2—Back View of Maxicator.

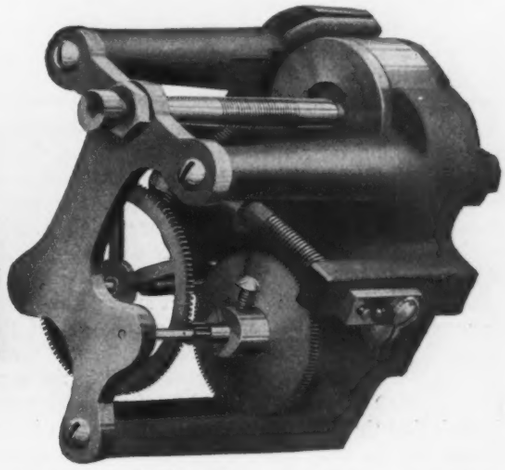


Fig. 3—Contact-Making Motor Used with Maxicator.

## METER-PROTECTIVE FITTING.

The accompanying illustration shows a meter-protective device brought out by the Appleton Electric Company, 212 North Jefferson Street, Chicago. A sealable stamped steel box is interposed between the cut-out cabinet and the watt-hour meter, thus eliminating loose or dangling wires and at the same time protecting the service company against theft of energy. Inside the box is a porcelain block upon which are mounted five brass terminals. The feed wires enter the box through the conduit, and on the opposite side of the block are five holes each large enough to pass a No. 10 wire lead to the meter. This side of the box is closed by a steel plate and is sealed until such time as the service company wishes to make the connection. The boxes are equipped in such a manner that the electrical contractor may attach his wires to one end of the terminal. When the service company is ready to make connection it attaches its wires to the opposite end of the terminals and then connects with the watt-hour meter. The boxes are also designed so that the cover as well as the steel plate on the side of the box can be sealed. Several types and sizes of these boxes are made.

Meter-Protective Device.

## OVERSPEED LIMIT DEVICE.

A new overspeed limit device for rotary converters and motor-generator sets, illustrated herewith, has been developed by the Westinghouse Electric & Manufacturing Company and will be furnished on all Westinghouse rotary converters built in the future and, when especially ordered, on motor-generators. Fig. 1 shows the application of the new device to the end of a rotary converter shaft and Fig. 2 illustrates the details. Advantageous features claimed for the new device are as follows: (1) Positive action; (2) few parts; (3) rugged construction; (4) compactness.

The operation of the mechanism will be apparent from an inspection of Fig. 2. Normally the trip lever is held in the position shown in full lines by the trip spring. If the speed of the machine exceeds the value (usually 15 per cent overspeed) for which the device is set, the trip lever, owing to its centrifugal force, flies outward positively and quickly and, knocking over the switch arm, closes the switch. A most interesting and important point in connection with its action is its positiveness. If the trip lever starts to fly out, the speed remaining constant or increasing, it will continue until it strikes the stop. This action is due to the proportions and disposition of the trip spring and the trip lever.

The point on the trip lever that strikes the switch arm is, approximately, at the center of percussion of the lever, a fact which insures an effective blow being struck by the lever. Normally the switch arm is held in the open position by a toggle spring. The relation of the spring to the lever is such that the resisting torque of the spring is a minimum. When the trip lever strikes the switch arm it forces the arm past the center point of the toggle mechanism, and the switch, under the spring's tension, closes of itself. It is only necessary for the trip lever to move the arm a small distance, possibly 3/32 in., to insure that the switch will close. The relation of the parts is such that when the arm is in the closed position the contacts are forced against the contact blocks with considerable pressure—much more pressure than is required to trip the switch.

To reset the switch it is merely necessary to move the switch arm back to the normal position by hand. This can be readily done at any time, whether the machine is running or not and without opening the switch box. That very few parts are involved is evident from an inspection of the illustrations. The minimum diameter for any bearing pin is ½ in., and the other parts are correspondingly strong.

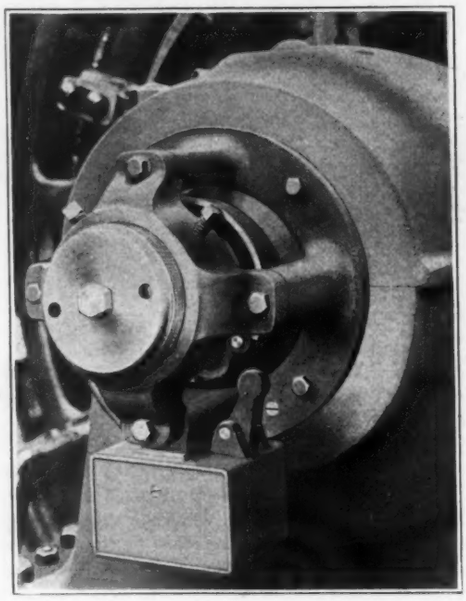


Fig. 1—Application of Overspeed Limit Device.

Adjusting screws are provided whereby the position of the trip lever can be closely regulated so that it will act at the predetermined speed. The sensitiveness of action of the switch arm can also be regulated by an adjusting screw.

Electrical connections for the new device will be the same as those used for the former Westinghouse overspeed trip arrangement. If the converter attains an overspeed, the trip lever flies out, the switch arm forces its contacts against the contact blocks, and an auxiliary circuit is closed. With the usual scheme of connections, the closing of this circuit

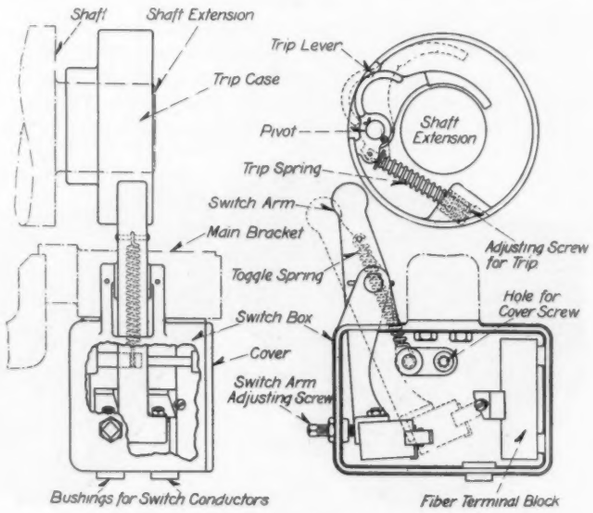



Fig. 2—Details of Overspeed Limit Device.

energizes the solenoid of a tripping device (on the alternating-current circuit-breakers), which operates and opens the breakers, cutting the machine from its source of supply.

In addition to the overspeed limit switch illustrated, which must reset manually, another switch has been developed which can be reset by a solenoid arranged within the switch box.

## MINNEAPOLIS ELECTRICAL EXPOSITION.

That electrical shows can still be made interesting and instructive was demonstrated at the Electrical Exposition held in the Minneapolis Armory, March 16 to 23. There were eighty exhibits from thirty cities, including a number of novel appliances manufactured in the Northwest and introduced here for the first time. Local high-school boys displayed some very creditable amateur apparatus, high-frequency coils, etc. Prof. M. M. Wood gave frequent demonstrations of some beautiful phosphorescent and fluorescent paint materials excited by ordinary light and ultra-violet rays, and showed some surprising manifestations of the gyroscope. The auditorium lighting effects were most attractive and artistic. A crystal chandelier containing 1000 20-cp lamps was the central feature, while above and beyond it there twinkled against the black background several hundred "stars" of different colors, made up of 20-cp lamps in "skedoodle" sockets. The booths were divided by verde-antique barriers surmounted by 100-watt lamps in amber papier-maché globes. Each day of the exposition was named after an electrical pioneer, and congratulatory telegrams were sent by Edison, Tesla, Westinghouse, Bell, Steinmetz, Brush and Thomson, the messages being received by such distinguished lay personages as Governor A. O. Eberhart, Archbishop John Ireland, President E. G. Pennington of the "Soo" Railroad, Mayor J. C. Haynes of Minneapolis, Mayor H. P. Kellar of St. Paul and President G. E. Vincent of the University of Minnesota. The Minneapolis General Electric Company made a number of exhibits at the exposition, one of the most attractive being its miniature "house electrical," fitted out complete even to a tiny radiant toaster and an operative toy electric range. The scenic setting for the house afforded a demonstration of curb lighting and electric vehicles on a toyland scale. Mr. R. W. Clark was in charge of the fourth Northwestern Electrical Exposition.

## AUTOMATIC STARTING CONTROL FOR MOTOR-DRIVEN CRANK SHAPER.

The accompanying illustrations show the application of automatic starting control to a motor-driven crank shaper. The machine illustrated is a 24-in. Gould & Eberhardt crank shaper driven by a 5-hp Reliance adjustable-speed motor of the armature shifting type with a speed range of from 300 to 500 r.p.m. Speed adjustments are obtained by the mechanical shifting of the motor armature. This is controlled by the hand-wheel *A* on the equipment illustrated. With the speed set for a given operation the motor may be stopped and started without further attention to the speed adjustment.

By using a motor with a speed range equal to the ratio of the back gear an unbroken range of cutting strokes is obtained from 4½ to 115. The great number of cutting strokes throughout this range combined with ample power at all speeds insures maximum output for any size cut on any kind of material.

The starting and stopping of the motor are controlled by an automatic starter through the drum switch *B*. This switch has three points, "start," "off" and "brake." To start the motor it is simply necessary for the operator to throw the switch to the starting position. When the switch is thrown to the "off" position the power is shut off and the machine stops in the usual manner. When the switch is thrown to the "brake" position the motor is automatically brought to a stop almost instantly. This method of stopping, it is claimed, eliminates the necessity of a clutch, which it will be noted is not used on the shaper illustrated.

The starter is of the series-control type and, it is claimed, automatically takes care of all starting conditions, besides removing all possibility of abuse to the motor or starting equipment. The starter itself is mounted on a nearby post and all wires are carried in conduit tapped directly into the drum switch, thus doing away with exposed wiring and contacts about the machine.

The speed dial *C* is a device for use with the motor

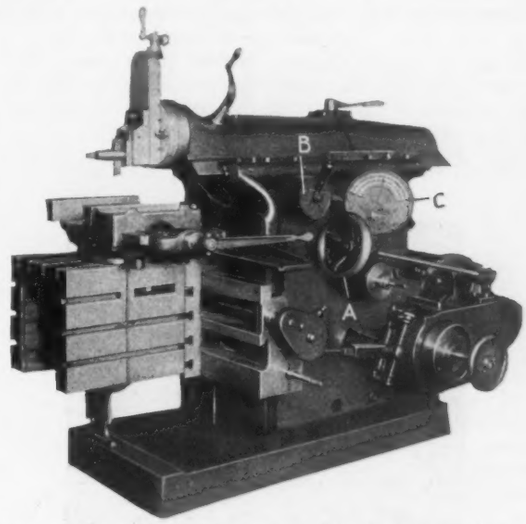



Fig. 1—Crank Shaper Driven by Adjustable-Speed Motor.

so as to permit of instantly setting the speed of the motor to give any desired speed at the cutting tool. This device is in the nature of a circular slide rule, and in the case of a shaper is designed to take into account variable factors, such as the ratio of the drive, the length of stroke and the cutting speed desired.

The method of using the dial is simple. Assuming that on the shaper illustrated it is desired to take a cut of 40 ft. a minute with a stroke of 20 in., the small knurl on the front of the dial is turned until the indicator which moves

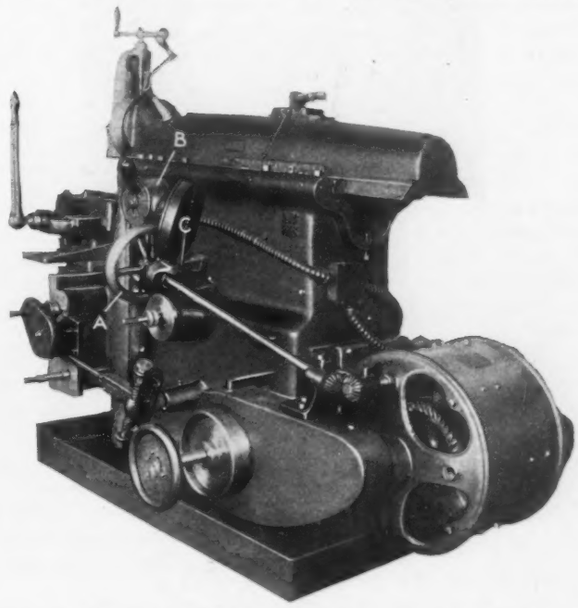



Fig. 2—Crank Shaper Driven by Adjustable-Speed Motor.

about the top scale is opposite 40, which is the cutting speed in feet per minute. The motor armature is then adjusted by turning the hand-wheel *A* until the pointer of the dial is opposite 20, which is the stroke to be used. No other operation is necessary, and the desired result is obtained without any guesswork on the part of the operator. The dial not only serves as a guide in setting the

speed accurately, but is always in sight as an indication to the foreman or inspector of the speeds in use by the operator. The equipment is built by the Reliance Electric & Engineering Company, Cleveland, Ohio.

## DIFFUSING FIXTURES FOR TUNGSTEN UNITS.

The growing popularity of the tungsten lamp, which is supplanting in a large measure the old-style carbon arc lamp for outdoor lighting and the later type of metallic arc lamp for indoor lighting, has created a demand for an inclosing medium which shall be of artistic design, light in weight and capable of diffusing the brilliant rays of the

Diffusing Lamp Fixture.

metallic filament, and yet absorbing a minimum amount of light.

The illuminating-glass manufacturer has combined his effort with that of the fixture designer to produce such a unit. The accompanying photograph shows the new Haskins-Lucida 16-in. sphere unit, manufactured by the Haskins Glass Company, Martins Ferry, Ohio. The two halves of the sphere are held together by means of a flange ring with a hinge on one side, allowing the unit to be opened to permit removal of the lamp. The sphere is supported by a chain hanging terminating in a holder which is made to fit the opening in the top of the sphere and is large enough to accommodate the large-base 500-watt tungsten lamp.

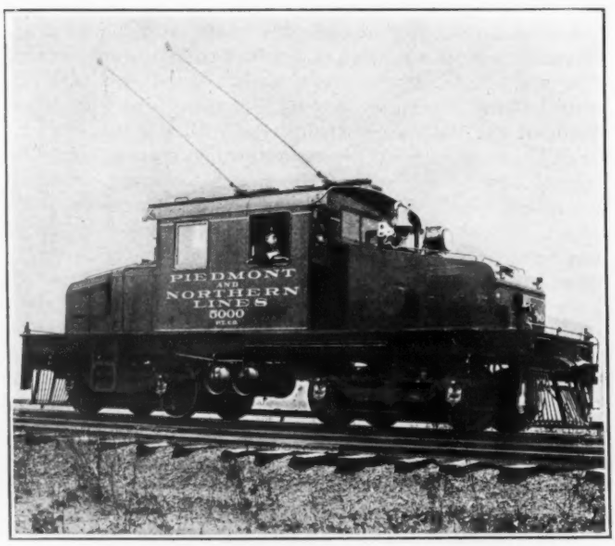
## CHICAGO EXHIBITION OF RAILWAY APPLIANCES.

Under the supervision of the National Railway Appliances Association, an excellent and pleasingly arranged exhibition of railway appliances was given in the Coliseum, Chicago, during the week ending March 23. During this week also the annual convention of the American Railway Engineering Association was held at the Congress Hotel, Chicago. A considerable proportion of the exhibits were of appliances in which some use of electricity is made. There were electric turntables, electric hoists, crossing signals, electric motors, dynamos driven by oil or gas engines, bare and insulated wires and cables, primary and storage batteries, incandescent lamps, motor and switchboard panels, rectifiers, motor-generators, electric blueprinting machines, electrically driven track-construction tools, electric pumps and a large variety of electrical apparatus used in train dispatching and signaling. Railroads are large buyers of electrical apparatus, and the fact is indicated plainly by the attention paid to exhibits of an electrical nature at this annual exhibition.

Among the exhibitors of apparatus of an electrical nature were the following: Adams & Westlake Company, American Steel & Wire Company, Bryant Zinc Company, Chicago Pneumatic Tool Company, Chicago Railway Equipment Company, Thomas A. Edison, Inc., Edison Storage Battery Company, Fairbanks, Morse & Company, General Electric Company, H. W. Johns-Manville Company, Kellogg Switchboard & Supply Company, Kerite Insulated Wire & Cable Company, National Carbon Company, George P. Nichols & Brother, Northwestern Manufacturing Company, Okonite Company, Sandwich Electric Company, Standard Underground Cable Company, United States Electric Company, United States Light & Heating Company and Western Electric Company.

## DIRECT-CURRENT LOCOMOTIVE FOR 1,500-VOLT SERVICE.

In the accompanying illustration is shown a locomotive, built for the Piedmont Traction Company, which will operate an extensive railroad system in the Piedmont section in North and South Carolina. This locomotive is one of six to operate at an emf of 1500 volts direct current, which is said to be the highest direct-current voltage used by any electric railway in the United States. The locomotive weighs 55 tons and is equipped with four 750-volt motors which have a rating of 180 hp. Each locomotive is able to haul forty freight cars weighing 45 tons each with load




Direct-Current Locomotive for 1500-Volt Service.

at 20.5 miles per hour on a straight level track, or nine cars at the same speed on a 7 per cent grade.

The motor equipment is controlled by the electro-pneumatic, unit-switch type of control.

The mechanical parts of the locomotive were built by the Baldwin Locomotive Works, Philadelphia, and the electrical equipment by the Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa.

# Industrial and Commercial News

ALTHOUGH it seems almost certain at the present time that suspension of work in the coal fields in this country will take place upon expiration of the agreement between operators and miners, it is believed that satisfactory terms will be arranged between the two parties and a prolonged shut-down averted. The unsettled labor situation has been still further agitated this week by refusal of fifty Eastern railroads to grant the demands of their locomotive engineers and by fresh outbreaks in several of the textile districts. Whether the engineers shall strike or not has been left to a vote of the brotherhood. There is a strong hope for peace in the English coal fields as a result of passage of the minimum wage bill, which the miners may decide to accept, temporarily at least. In view of these disturbing elements business has become more irregular than in recent weeks. Progress continues to be made slowly, but a conservative tone is very noticeable in all transactions. Rates in the money market March 27 were: Call, 2⅜@2¾ per cent; ninety days, 3¼ per cent.

## THE COPPER MARKET.

Large transactions in the London market in the closing days last week, accompanied by higher prices, incited a wave of activity in this country, on which prices were carried above the 15-cent level and a large volume of heavy sales took place. Several of the selling agencies advanced their quotations to 15½ cents per pound, but most of the new business was placed at small fractions below 15 cents. Domestic consumers are now being asked to pay 15¼ cents by the majority of agencies for electrolytic, delivered thirty days. Wire drawers and electric companies apparently covered their requirements for several months during the rise and a mild reaction in the buying movement has resulted. In spite of this many producers believe that this upward movement, for which they have been working for some months, will shortly carry prices to 16 cents. With improvement in British industrial conditions further increase in foreign demand is expected, and this activity is counted upon to sustain the speculative advance inaugurated last week. Exports since the first of the month, including March 27, aggregate 22,450 tons. The daily call on the Metal Exchange March 27 quoted copper as per the accompanying table.

| Standard. | Bid. | Asked. | Settling Price. |
|---|---|---|---|
| Spot | 15.20 | 15.37½ | ..... |
| March | 15.22½ | 15.37½ | 15.30 |
| April | 15.25 | 15.37½ | 15.32½ |
| May | 15.30 | 15.50 | 15.40 |
| June | 15.32½ | 15.35 | 15.35 |
| July | 15.32½ | 15.35 | 15.35 |

The London market, March 27, was as follows:

| | Noon. £ | s | d | Closing. £ | s | d |
|---|---|---|---|---|---|---|
| Standard copper, spot | 68 | 5 | 0 | 68 | 15 | 0 |
| Standard copper, futures | 69 | 2 | 6 | 69 | 12 | 6 |

Price extremes in 1912:

| | Highest. | Lowest. |
|---|---|---|
| Standard | 15.28c | 13.65c |
| London, spot | £68 15 0 | £60 16 3 |
| London, futures | 69 12 6 | 61 10 0 |
| Best selected | 73 0 0 | 65 5 0 |

## INDUSTRIAL AND COMMERCIAL NOTES.

**Blackstone Valley Consolidation.**—The Stone & Webster interests of Boston, Mass., have filed a bill in the Rhode Island Legislature to effect a consolidation of the four principal public utilities in the Woonsocket and Pawtucket district, these companies all being under the control and management of the syndicate. The merger is to include the Woonsocket Electric Machine & Power Company, the Woonsocket Gas Company, the Pawtucket Gas Company and the Pawtucket Electric Company, together with two holding organizations called the Blackstone Valley Gas & Electric Company, incorporated in Maine, and the Pawtucket Gas Company, incorporated in New Jersey. The utilities in the city of Providence are unaffected. The plan provides for an issue of capital stock in the sum of $4,000,000, with the privilege of increasing the stock to $8,000,000, and also for an issue of bonds up to $8,000,000. The title of the new organization will be the Blackstone Valley Gas & Electric Company, the offices being in Pawtucket. Provision is made whereby, in the event of 80 per cent of the stockholders of the above corporations consolidated by the merger voting to sell or lease their properties to the proposed new corporation, the right of appeal to the courts and a jury to compel the remaining 20 per cent to follow suit may be invoked. Among the incorporators are Messrs. C. A. Stone, E. S. Webster, Russell Robb, J. W. Hallowell, F. S. Pratt, F. T. Royce, F. B. Bemis, Stedman Buttrick, F. F. Sherburn, C. H. Darling, G. R. Smith and C. E. Ballou.

**Crocker-Wheeler Shipments.**—Recent shipments by the Crocker-Wheeler Company, Ampere, N. J., include two 4500-kva, three-phase, 25-cycle, 66,000/33,000 to 13,200/6,600-volt water-cooled transformers for the Great Northern Power Company, Duluth, Minn. Another shipment is the first of two 4500-kva, 25-cycle, three-phase, 1500-r.p.m. generators to be installed in the plant of the Illinois Steel Company, South Chicago, the other to follow when the first has been erected. A third shipment includes two 400-kva, single-phase, 60-cycle Remek type transformers for the Keystone Tube Company, Connellsville, Pa. These transformers are wound for a primary voltage of 268-172 and for a secondary voltage of 6.3-2.73 and will be used for tube welding. Three 200-kva, single-phase, 60-cycle, self-cooled transformers have been shipped to the Pennsylvania Central Lighting & Power Company, of Gallatin, Pa. These units are wound for a primary voltage of 26,000; they are star-connected for 45,000 volts, and they have a secondary voltage of 2,500. Four 150-kva, single-phase water-cooled transformers have been shipped to the Pacific Gas & Electric Company. Their primary voltage is 31,215; they are star-connected for 54,000 volts, and their secondary voltage is 13,200/6600.

**New Apparatus for a St. Paul Generating Station.**—The Northern Heating & Electric Company, of St. Paul, Minn., which is one of the properties managed by H. M. Byllesby & Company, has closed a contract with the Westinghouse Electric & Manufacturing Company for a 5000-kva turbo-generator unit to deliver three-phase, 2300-volt, 60-cycle energy. The same contract includes a 100-kw turbine-driven exciter set. The Northern company is owned and operated by the Consumers' Power Company, and its power house is already equipped with Westinghouse steam turbines and generators.

**Alabama Traction, Light & Power Company, Ltd., Directors.**—James Mitchell, Martin Littleton, John F. Wallace, James R. Morse, Laurence Macfarlane, W. D. Ross, Frank S. Washburn, T. S. Worthington and John B. White have been chosen directors of the Alabama Traction, Light & Power Company, Ltd., which will construct and operate electric plants in Birmingham, Mobile, Montgomery and other cities in Alabama as mentioned in these columns March 16.

**English Electrical Appliances Exhibition.**—An exhibition of electrical appliances will be held in Bingley Hall, Birmingham, England, from Oct. 7 to 26, 1912. Particulars as to space, charges, etc., can be obtained upon application to George Stanley, Winchester House, Victoria Square, Birmingham, who is the secretary of the exhibition.

**Bronx Gas & Electric Improvements.**—The Public Service Commission for the First District of New York has authorized the Bronx Gas & Electric Company, New York, to expend $18,046 out of the proceeds of a bond issue heretofore authorized. The expenditure is to be for the improvement of the company's plant.

**American Telephone & Telegraph Meeting.**—At the annual meeting of the American Telephone & Telegraph Company, on March 26, G. P. Gardner, Charles F. Adams, 2d, and Richard Olney were elected directors to succeed Thomas Sanders, deceased, and Thomas B. Bailey and Frank E. Warren, resigned.

**W. S. Barstow & Company Changes.**—The firm of W. S. Barstow & Company, 50 Pine Street, New York, consulting engineers and managers of a number of gas and electric properties in several states, has broadened its interests and, in addition to engineering and operating will hereafter take up the financing of public service properties. In connection with this new arrangement, Lucien H. Tyng, of the recent banking firm of Fuqua, Tyng & Company, and George C. White, Jr., of the recent banking firm of George C. White, Jr., & Company, have become directors and vice-presidents of W. S. Barstow & Company. The latter has sold to Montgomery, Clothier & Tyler, bankers, of Philadelphia, its controlling interest in the Associated Gas & Electric Company, New York. This was incorporated March 17, 1906, in New York as a holding company, and in October, 1909, the controlling interest was acquired by the Barstow company. The Associated Gas & Electric Company owns a controlling interest in the following companies: Ithaca (N. Y.) Electric Light & Power Company, Ithaca (N. Y.) Gas Light Company, Norwich (N. Y.) Gas & Electric Company, Van Wert (Ohio) Gas Light Company, Bethlehem (Pa.) Consolidated Gas Company, Canisteo (N. Y.) Gas Company, Greenville (Ohio) Gas Light Company, Homer & Cortland (N. Y.) Gas Light Company and the Hornell (N. Y.) Gas Light Company. The officers are: W. S. Barstow, president; Joseph B. Taylor, secretary; O. Clement Swenson, treasurer, all of New York City.

**American Utilities Company Organization.**—Details concerning the American Utilities Company, recently incorporated in New York, are now available. The company is capitalized at $2,000,000, of which $1,000,000 is preferred stock and $1,000,000 is common stock. All of the common stock and $500,000 of the preferred stock have been issued. The latter has preference both as to principal and dividends. It is cumulative from Feb. 1, 1912, at the rate of 6 per cent per annum and from Feb. 1, 1914, at 7 per cent per annum. The officers of the company are as follows: President, William P. Bonbright; vice-presidents, S. W. Childs and Morris W. Stroud, Jr.; secretary and treasurer, J. P. Carey. The directors are: William P. Bonbright, Starling W. Childs, Samuel M. Clement, Jr., Alexander D. Grange, Walter H. Lippincott, John C. Lowry, Charles H. Ludington, Frederick W. Stehr, Morris W. Stroud, Morris W. Stroud, Jr., Joseph B. Townsend, Jr., and Charlton Yarnall.

**Electrical Apparatus for United States Reclamation Service.**—Sealed proposals will be received at the office of the United States Reclamation Service, Los Angeles, Cal., until 2 p. m., April 8, 1912, for furnishing electrical apparatus for the Truckee-Carson Project, Nevada. Bids are wanted on three 150-kva and three 75-kva, single-phase, self-cooled, shell-type transformers, a variety of switchboard apparatus and two three-phase, 33,000-volt electrolytic lightning arresters. Details may be obtained from the United States Reclamation Service, 605 Federal Building, Los Angeles, Cal., or Washington, D. C.

**Additions to Merchants' System, Indianapolis.**—The Merchants' Heat & Light Company, of Indianapolis, Ind., has entered an order for a new 5000-kw Westinghouse bleeder-type steam turbine for its generating station. A fourth substation is also to be built in the northwest section of the city and one 750-kw, one 500-kw and one 300-kw motor-generator set have been purchased of the same manufacturer.

**Southern Telephone & Telegraph Meeting.**—At the annual meeting of the Southern Telephone & Telegraph Company U. N. Bethell and C. H. Wilson were elected directors to succeed J. H. Cahill and P. Dexter. Other retiring directors were re-elected.

**More Telephone and Telegraph Lines for Roumania.**—The Director of Posts and Telegraphs, Roumania, has decided to construct several new telephone and telegraph lines during the year, for which 1,300,000 francs has been appropriated.

**Construction of Savannah (Ga.) Electric Company's Plant Begun.**—Excavation work for the foundations for the million-dollar plant of the Savannah Electric Company, a Stone & Webster property, is now under way.

**Aluminum Notes and Prices.**—The aluminum market continues steady, prices as of March 27 being 19@20 cents for ingots for remelting, in large lots, 31 cents for rods and wire and 33 cents for sheets.

# Financial

**Marconi Company Absorbs United Wireless.**—It developed this week that arrangements have been made whereby the Marconi Wireless Telegraph Company will assume control of the United Wireless Telegraph Company, which has been undergoing reorganization since last year, when its affairs became involved through illegal methods used by several of its officers in connection with the sale of stock. That a merger would take place was announced on March 25, when the suit of the Marconi company against the United company for infringement of patent rights was called. A statement issued by Godfrey C. Isaacs, managing director of the Marconi company, gave the facts as follows: "In the United States District Court to-day the United Wireless Telegraph Company of America, through its trustees in bankruptcy, withdrew its defense, admitted the validity of the Marconi patents and submitted to judgment in favor of the Marconi company. Arrangements have now been concluded between the Marconi interests and Arthur P. West, chairman of the reorganization committee of stockholders of the United Wireless Telegraph Company, which provide for the passing into possession and control of the Marconi Wireless Telegraph Company of about 500 ship stations and seventy land stations situated in the United States, which had been equipped and worked by the United Wireless Company. These arrangements not only embrace a satisfactory settlement of all outstanding litigation but secure for the stockholders of the United Wireless Company an eminently satisfactory solution of a complicated entanglement of their affairs which at one time threatened disaster. Those acting in the interests of the stockholders are to be highly congratulated upon the able manner in which they have steered a wrecked ship to a safe port." As we go to press details of the merger have not been worked out, but a representative of the *Electrical World* was told on March 27 that the financial arrangements would be made public possibly by the end of this week, though this was purely speculative. The annual report of the Marconi Wireless Telegraph Company of America shows a profit for the year of $16,992. John Bottomley, vice-president of the company, called attention to the broadening of the company's activities on the Pacific coast, stating that while there has not been much time in which to try out new installations fully, receipts are satisfactory, and that it is the intention of the company to erect additional stations on the Pacific coast at prominent points, so that the service in that part of the country will rank with that on the Atlantic coast in efficiency and certainty of operation. Suit was brought against the Marconi Wireless Telegraph Company of America in the United States District Court on March 27 by the National Electric Signalling Company, which alleges infringement on a patent granted Aug. 12, 1902, to Reginald A. Fessenden for wireless-telegraph apparatus. This is the patent which figured in a suit brought against the United Wireless company and in a decision handed down by Judge Hale of Portland, Maine, on Sept. 21, was declared to be infringed by that company.

**H. L. Doherty & Company Sue for Subscription Rights.**—Application has been made to the courts by H. L. Doherty & Company, 60 Wall Street, New York, for the right to subscribe to $1,000,000 par value of the common stock of the American Gas & Electric Company. They contend that by the agreement under which the company was formed they had an option to make this subscription within a five-year period. The date of expiration of this five-year period is in dispute, but the plaintiffs claim that they attempted to exercise their right within the period. Counsel for the Doherty company say that a restraining order has been granted by the Supreme Court against the issuance of any additional common stock by the company, this order being returnable March 28. As the American Gas & Electric Company, on Feb. 28, offered to its common stockholders the right to subscribe at par for $500,000 common stock, up to April 15 the restraining order, if enforced, will check issuance of any part of the new stock not already subscribed for by stockholders.

**Western Electric Earned $66,211,975 in 1911.**—The annual report of the Western Electric Company for the year ended Dec. 31, 1911, has been issued, and the income account

shown therein compares with that in the thirteen months ended Dec. 31, 1910, as follows: Gross sales, $66,211,975, as compared with $68,375,150; other income, $337,293, as compared with $486,305, making total income of $66,549,268, as compared with $68,861,455. Manufacturing costs, expenses, etc., were $62,414,067, as compared with $63,442,286, leaving net earnings of $4,135,201, as compared with $5,419,169. Interest charges were $854,909 and $884,893 in the respective periods, leaving a balance for dividends in 1911 of $3,280,292, equal to 21.87 per cent on $15,000,000 capital stock, as compared with $4,534,276, or 30.2 per cent, on the same stock for the thirteen months ended Dec. 31, 1910. Dividends were $1,500,000 in 1911 and $1,700,000 in the 1910 period, and $800,000 was carried to reserve in 1911, as against $1,150,000 in 1910, leaving a surplus of $980,292 in 1911, as compared with $1,684,276 in the thirteen months covered in the 1910 report. The general balance sheet as of Dec. 31, 1911, showed total assets of $57,411,815.

**Georgia Railway & Power Company Charged with Restraint of Trade.**—Louis B. Magid, of Atlanta, Ga., a stockholder in the Atlanta Hydroelectric Power Company, has filed suits for $2,181,000 damages and for a perpetual injunction restraining the merger of a number of public-utility companies under the name of the Georgia Railway & Power Company. This merger, it is understood, is now effective, the merged companies being known as the Georgia Railway & Power Company. This combination of gas, electric light, power and railway companies in the northern part of the State will have a capitalization of $27,000,000 stock and $30,000,000 bonds, as previously noted in these columns. Mr. Magid charges that the merging of these interests constitutes a restraint of trade in violation of the Sherman anti-trust law, alleging that there is a conspiracy by the allied interests to monopolize lighting and power business in the State. The officers of the new company are: Preston S. Arkwright, president; H. M. Atkinson, chairman of the board; G. W. Brine, vice-president and general manager; W. H. Glenn, vice-president and secretary; I. S. Mitchell, Jr., treasurer, and Harry Flynn, auditor.

**Westinghouse Company Declares Common Dividend.**—Directors of the Westinghouse Electric & Manufacturing Company at a meeting March 27 voted a dividend of 1 per cent on the common stock, the first dividend on this issue since 1907, when the company went into a receivership. As explained in a statement issued by the directors which follows, this act is not to be regarded as placing the stock on a fixed annual rate of dividend. The statement said: "The question of the next dividend will not be considered for six months. The rate will then be decided upon after a full consideration of the earnings of the company during that period and the prospects for the future. Having in view the uncertainty now surrounding business generally and the necessity of the company preparing to meet maturing obligations, together with the necessary demands for increases in its business and the conservation of its facilities, the directors feel that this is quite in line with the conservative management of this great property."

**Allis-Chalmers Plan Submitted to Security Holders.**—Notice has been given to holders of bonds and stock of the Allis-Chalmers Company that a plan and agreement for reorganization has been adopted and lodged with the Central Trust Company of New York, as depositary, and that holders of these securities are invited to participate under the terms of the plan in the reorganization of the company. Details of this plan were given in these columns last week. All deposits of securities in accordance with the plan must be made prior to May 1, 1912. The members of the reorganization committee are: James N. Wallace, chairman; John H. McClement, Charles W. Cox, Alexander J. Hemphill, R. Walter Leigh, W. Emlen Roosevelt and Fred Vogel, Jr. Messrs. Wallace and Hemphill have formed a syndicate which will underwrite the $5,192,000 assessment on the preferred and common stock of the Allis-Chalmers Company.

**Havana Electric Railway & Power Company Incorporated.**—In accordance with the plan for merging the street railway, lighting and power companies in Havana, as outlined in the *Electrical World* March 16, the Havana Electric Railway & Power Company, with an authorized capital of $30,000,000, was incorporated in Trenton, N. J., March 26. The company is authorized to construct, acquire and operate an electric railway, and light and power plants in the West India Islands and the United States. It is also authorized to acquire $5,000,000 of the preferred stock and $7,500,000 of the common stock of the Havana Electric Railway Company and to acquire $6,000,000 of the capital stock of the Gas & Electric Company of Havana. The capital of the company is divided into $15,000,000 preferred stock and $15,000,000 common stock.

**Electric Bond & Share Report.**—The balance sheet of the Electric Bond & Share Company, 71 Broadway, New York, as of Dec. 31, 1911, shows cash on hand and in banks of $895,598; accounts receivable, $51,160; notes receivable, $989,265; interest accrued receivable, $60,748; total current assets, $1,996,772; syndicate holdings, underwritings and advances, $1,049,401; investments, $3,748,086; surplus and undivided profits, $2,314,223, and total assets and liabilities of $6,794,261. Benjamin Strong, Jr., vice-president of the Bankers' Trust Company, has been elected a director of the Electric Bond & Share Company and a member of the executive committee. Other members of the executive committee just elected are Marsden J. Perry, C. A. Coffin, A. C. Bedford, Hinsdill Parsons and S. Z. Mitchell.

**Electric Storage Battery Earnings Increase.**—Substantial improvement in the earnings of the Electric Storage Battery Company, Philadelphia, is shown in the annual report of the company for the year ended Dec. 31, 1911. Gross sales, less cost of manufacturing, etc., were $1,479,453, against $1,314,223 in 1910. Operating expenses were $452,706, as compared with $442,650, and net earnings were $1,026,747, as compared with $871,572. Total net income was $1,263,608, as compared with $1,120,012, a gain of $143,596, and was equal to 7.77 per cent on $16,249,425 capital stock, against 6.88 per cent in 1910. After payment of 4 per cent dividends, $546,138 was added to the surplus, making a total surplus of $3,318,080, as compared with $2,771,942 in 1910.

**Winnipeg Utilities Plans.**—A syndicate composed of local men at Winnipeg, Man., of which E. B. Reese and R. R. Muir are at the head, is promoting a plan to take over the Winnipeg Electric Railway and subsidiary lines. The same interests have charters for a number of suburban electric railways and steam railroads and own a power site at Big Bonnet Falls on the Winnipeg River, all of which they propose to develop at once. The city of Winnipeg is opposing the charters in the Legislature, claiming that they will injuriously affect the city's rights to take over the present street railway in Winnipeg at the expiration of the charter term in 1927. It is expected that all the differences will be settled satisfactorily in the near future.

**United Properties Company Changes.**—The San Francisco-Oakland Terminal Railways has been organized to operate the Oakland Traction Company, the San Francisco, Oakland & San José Consolidated Railway and the other railway companies heretofore operated by the United Light & Power Company, details of which were given in these columns Feb. 17. Segregation of the traction and lighting properties of the United Light & Power Company will be the outcome of the organization of the new railroad company. All of the stock of the United Light & Power Company is owned by the United Properties Company of California.

**Laco-Philips Company.**—Owing to the growth of their tungsten lamp department, Lamont, Corliss & Company, importers and agents for manufacturers, have formed a separate organization for the lamp branch of their business, under the name of the Laco-Philips Company. The manufacturers of "Laco" lamps, the Philips Metallic Glowlampworks, Ltd., of Eindhoven, Holland, will participate in the further development of the American business, by reason of their co-operation with and interest in the company. All lamp contracts have been taken over for fulfilment by the Laco-Philips Company, and hereafter all orders for Laco lamps will be filled by it.

**New York Telephone Earnings Decreased in 1911.**—Net earnings of the New York Telephone Company in the year ended Dec. 31, 1911, showed a decrease of $442,388 as compared with those in 1910, in spite of the fact that gross revenue was substantially larger. Gross revenue was $39,189,966, as compared with $36,353,899, an increase of $2,836,067, and expenses and taxes were $29,013,188, as against $25,734,733, an increase of $3,278,455. Net earnings were

$10,176,777, as compared with $10,619,165, a decrease of $442,388, as above. The surplus for the year was $2,827,194, as compared with $3,633,512 in 1910, a decrease of $806,318.

**North American Company Has Prosperous Year.**—The annual report of the North American Company for the year ended Dec. 31, 1911, shows a surplus after payment of $1,489,665 in dividends of $367,201, comparing with $363,720 in 1910. Total receipts were $2,105,993, comparing with $2,105,003; rents, taxes, etc., were $249,127, comparing with $251,618, and undivided profits were $1,856,866, comparing with $1,853,385. Dividends, as above, were $1,489,665. The balance sheet as of Dec. 31 last shows total assets and liabilities of $40,026,981.

**Missouri & Kansas Telephone Statement.**—Gross earnings of the Missouri & Kansas Telephone Company for the year ended Dec. 31, 1911, were $3,523,033, as compared with $3,182,397 in 1910. Expenses and taxes were $2,823,992, against $2,501,155, and net earnings were $699,041, as compared with $681,242. Interest and depreciation were $699,041, as compared with $681,242. A previous deficit of $575,317 is now standing against the company. Total assets and liabilities as of Dec. 31, 1911, were $22,287,892.

**Initial Dividend by Puget Sound Traction, Light & Power Company.**—This company has declared initial quarterly dividends of $1.50 and $1 per share on its $6,968,333 preferred and $16,546,360 common stock respectively. The outstanding $1,963,000 first-mortgage 5 per cent gold bonds of the Seattle-Tacoma Power Company, dated June 1, 1905, have been called for payment at 105 and interest on June 1, at the office of the Northern Trust Company of Chicago, trustee.

**Pacific Gas & Electric Calls Bonds.**—The Pacific Gas & Electric Company has called for payment at par on June 15 its outstanding 6 per cent debenture-mortgage bonds due Dec. 15, 1937, amounting to $3,884,000. The Pacific Gas & Electric Company, it is understood, has acquired the South San Francisco Light & Power Company, which serves South San Francisco and several small towns in the vicinity and supplies energy to a number of large factories.

**Washington Water Power Notes.**—Announcement is made by David W. Huntington, president of the Washington Water Power Company, that the board of directors of the company will meet in New York on April 1 to declare the regular quarterly dividend. The total outstanding stock is $14,160,000, paying a dividend of 8 per cent.

**H. L. Doherty & Company Acquire Ohio Company.**—The Alliance Gas & Power Company, of Alliance, Ohio, has been purchased by H. L. Doherty & Company, 60 Wall Street, New York City.

MARKET PRICES.

| | Mar. 20. | Mar. 27. | | Mar. 20. | Mar. 27. |
|---|---|---|---|---|---|
| Allis-Chalmers ..... | ⅞ | ⅝ | Mackay Companies.. | 79½ | 79½* |
| Allis-Chalmers, pf.. | 4 | 4 | Mackay Cos., pf.... | 70* | 70* |
| Amalgamated Cop.. | 76½ | 80¾ | Philadelphia Elec... | 18¼ | 18 |
| Boston Edison..... | 298 | 299 | Western Union..... | †83⅝ | 83⅞ |
| C'monwealth Edison. | 147 | 146½ | Westinghouse ..... | 74½ | 78½ |
| Elec. Storage Bty.. | 56⅛ | 54½ | Westinghouse, pf... | 120¼* | 121⅛ |
| General Electric.... | 166¼ | 166¾ | | | |

*Last price quoted. †Ex-div.

# Personal

**Mr. William Converse** has resigned his position as chief engineer of the Marlboro (Mass.) Electric Company to become engineer of works at the Bloomfield (N. J.) plant of the Westinghouse Lamp Company.

**Mr. Gleeson Murphy** has been appointed vice-president of the General Motors Truck Company. Mr. Murphy will be assistant to President Thomas Neal and will have supervisory control of the electrical interests.

**Mr. H. J. W. Fay,** of the Submarine Signal Company, will address the Worcester Polytechnic Institute branch of the American Institute of Electrical Engineers on April 12, his subject to be "Signaling Under Water."

**Mr. F. A. Brooks** has been engaged to take charge of the lighting supply department of the Wesco Supply Company, St. Louis. Mr. Brooks has been connected with the telephone and electric business for thirty years.

**Prof. W. N. Gladson,** head of the electrical-engineering department of the University of Arkansas, is the author of a report issued by the Geological Survey of Arkansas on the water-power of White River and some of its tributaries.

**Mr. Bertram M. Downs,** who enjoys a large acquaintance in the electrical field through his connection with it of over twenty-six years, has become associated with the Hemingray Glass Company, of Covington, Ky.

**Mr. W. A. Wadsworth** has resigned as sales manager for the Schenectady (N. Y.) Illuminating Company to become associated with the Electric Bond & Share Company of New York, with headquarters at Gadsden, Ala.

**Major George O. Squier** is the author of a paper in the April issue of the *Journal* of the Franklin Institute, entitled "Some Experiments in 'Wired-Wireless' Telegraphy for Field Lines of Information for Military Purposes."

**Mr. G. E. Palmer,** formerly electrical engineer for the Pettingell-Andrews Company, returned recently from a three months' trip to Europe. Mr. Palmer is planning to engage in the manufacturing of electrical apparatus in Boston.

**Mr. Frank L. Perry,** formerly business manager of the *Western Electrician,* addressed the Advertising Club of Baltimore on March 22, his subject being "Publicity for Public Utility Companies and Popular Unrest." The keynote of his advice was: "Be a good company and never stop telling the people how good you are."

**Mr. J. S. B. Plummer,** who for many years has acted as secretary to the Armorduct Manufacturing Company, of Farringdon Avenue, London, which deals in all kinds of electrical accessories and manufactures the well-known "Armorduct" system of conduit for electric wiring, has started for a trip round the world on behalf of the company.

**Mr. A. Larney** has been appointed manager of the new-business department of the Consumers' Power Company, in charge of commercial work among the Byllesby properties in Minnesota, the Dakotas, Montana and Illinois, with headquarters at St. Paul, Minn. Mr. E. T. Street, formerly new-business manager at St. Paul, was recently promoted to be electrical engineer there.

**Mr. L. F. Philo,** until recently sales manager of the Union Electric Light & Power Company, of St. Louis, has resigned that position and left St. Louis for New York, where he is now a member of the general sales staff of the Western Electric Company. Mr. Philo has taken a conspicuous part in the electrical affairs of St. Louis, and he leaves many friends and admirers in that city.

**Mr. Glenn C. Webster,** manager of the engineering department of the National Electric Lamp Association, Cleveland, Ohio, started March 12 on a trip through the South Atlantic and Gulf States, where he will visit the principal cities of Tennessee, North and South Carolina, Georgia, Florida, Alabama, Mississippi and Louisiana in the interests of the incandescent lamp industry.

**Mr. C. E. L. Brown,** the well-known electrical engineer of Baden, Switzerland, who was recently elected an honorary member of the American Institute of Electrical Engineers, arrived in San Francisco during the present week on a trip around the world. While in New York Mr. Brown will be tendered a reception by the A. I. E. E., at which function he will be formally notified of his election to honorary membership.

**Mr. Harry C. Adams, Jr.,** who has been secretary of the R. B. Corey Company for the past seven years, has become associated with the Phillips Insulated Wire Company, Pawtucket, R. I. Mr. Adams served his apprenticeship with the Thomson-Houston Company at Lynn, Mass., and later went with the Fort Wayne Electric Works. He subsequently entered the employ of the Phillips Insulated Wire Company, leaving that organization to join that of the R. B. Corey Company, from which concern he has just resigned.

# Obituary

**Dr. Antonio Pacinotti,** of Pisa, Italy, who constructed the first commercial type generator in 1861, died on March 24. Dr. Pacinotti was recently elected an honorary member of the American Institute of Electrical Engineers.

# Construction

BIRMINGHAM, ALA.—The City Commissioners have granted the Tidewater Pwr. Co. a franchise to construct and operate an electric light and power plant here for a period of 30 years.

BIRMINGHAM, ALA.—The Alabama Trac. Lt. & Pwr. Co., Ltd., recently incorporated in Canada with a capital stock of $30,000,000, has issued $10,000,000 first-mortgage bonds, the proceeds of $6,000,000 to be used for the acquisition of water-power and construction of initial hydroelectric power plant and transmission lines; the remaining $4,000,000 will be held for the purpose of acquiring additional public-utility companies. The company proposes to supply electricity for lamps, heat and motors in Birmingham, Montgomery, Mobile and other towns and cities in Alabama. James Mitchell, Martin Littleton and John F. Wallace are among the directors.

BOAZ, ALA.—Arrangements have been completed for the construction of an electric-light plant in Boaz. W. H. Bartlett is Mayor.

GADSDEN, ALA.—The special committee appointed by the Council to investigate the matter of installing an electric plant at the waterworks pumping station has decided to install a small plant. A small engine and generator will be purchased, which will be operated by excess steam from the boilers. Bids are now being received for the equipment.

MONTGOMERY, ALA.—The Montgomery Trac. Co. is planning to build an extension to Lederach, a distance of 6 miles, in the near future.

WILLIAMS, ARIZ.—Rights-of-way are being secured by capitalists for a scenic belt railway to be built from Williams south through the mountains.

ATKINS, ARK.—The Council has granted an electric-light franchise to W. T. Bledsoe and R. Hughey.

COTTER, ARK.—The Dixie Pwr. Co., Little Rock, contemplates the construction of a 60-ft. power dam on the White River, near Cotter. L. E. Fisher, St. Louis, is president, and Holman & Laird, St. Louis, are consulting engineers.

ALAMEDA, CAL.—As no bids were submitted for erecting electroliers in District No. 5, the City Council authorized the city electrician to go ahead with the work.

BISHOP, CAL.—The Bishop Lt. & Pwr. Co. is planning to erect a transmission line from Bishop Creek to Big Pine.

FRESNO, CAL.—It is reported that plans which are being prepared for the Ogle House include the installation of an electric-light plant.

LINDSAY, CAL.—The Tulare County Wtr. Co. has made arrangements with the San Joaquin Lt. & Pwr. Co. by which the latter company is to supply the former with 1000 hp to operate its system here until its hydroelectric system is in operation

LONG BEACH, CAL.—The Southern California Edison Co. has submitted a proposition to the Water Department to supply electricity to operate the three pumping plants of the city, the service to cost from 1 to 1½ cents per kw-hr.

MARTINEZ, CAL.—Dr. Frank Rattan, of Martinez, is interested in a project to build an electric railway from Muir Station on the Santa Fé railroad to this city, and thence along the waterfront to Bay Point, a distance of about 8 miles.

MARYSVILLE, CAL.—The Northern El. Ry. Co., Chico, has awarded a contract for the grading of its proposed electric railway from Marysville to Colusa, a distance of 27 miles. It is expected to have the extension completed by fall.

MAXWELL, CAL.—The Sacramento Valley Irrig. Co. has decided to install a three-stage pump having a capacity of 70,000 gal. per hour on its main canal near here, which will be operated by an 80-hp electric motor.

MERCED, CAL.—The San Joan Lt. & Pwr. Co., which is erecting a transmission line from Merced to Atwater, is contemplating extending the line from Atwater to Livingston. The company is also erecting a line to the Lone Tree district, 11 miles south of Merced.

MONTEREY, CAL.—The United Railroads of San Francisco is reported to have purchased the Pajaro Valley railroad, a narrow-gage steam road, which runs between Salinas and Moss Landing. It is proposed to equip the railroad for electrical operation and continue it north through Gilroy, San José and San Mateo. Work will soon begin on the construction on the new railway between Monterey and Salinas.

PLACERVILLE, CAL.—The Western States Gas & El. Co. is planning extensive improvements in this county, which will involve an expenditure of about $100,000 and include rebuilding flume, 7 miles long, repairs to dam, etc.

RICHMOND, CAL.—Application has been made to the City Council by H. C. Cutting for a 30-year franchise to construct and operate an electric railway over certain streets in Richmond. Bids for sale of the franchise will be received until April 13. R. I. Vaughn is clerk.

SAN FRANCISCO, CAL.—Plans have been completed by M. I. Diggs, state architect, for the San Francisco Armory, to be located at Mission and Fourteenth Streets, at a cost of $385,000. The plans provide for a power plant, equipped with boilers, turbine generators to furnish electricity, heat and ventilation for building, to cost about $45,000.

SAN JOSE, CAL.—The proposition to establish a lighting district in College Park was carried at an election held March 11. The district takes in all the territory between Santa Clara and San José, Cal. It is proposed to maintain 125 lamps, contract for which will soon be awarded.

SONORA, CAL.—The Sierra & San Francisco Pwr. Co. is planning to erect an electric line from the Phoenix Lake plant to a point above Strawberry, where the new dam is to be built. The company is now repairing its flume system at Forebay.

FORT COLLINS, COL.—In the issue of March 9 it was erroneously stated that the City Council has entered into a contract with the Greeley Hydro-Electric Lt. Co. to supply the city with electricity. A proposition to that effect has been made but not yet accepted by the Council.

GREELEY, COL.—The Greeley Hydro-Electric Co. is reported to have awarded a contract to L. W. Brainard, of Fort Collins, to furnish poles for 25 miles of its transmission line. Negotiations are under way for the installation of new machinery, which will increase the output of its plant to 1600 hp.

LOVELAND, COL.—The citizens are considering the question whether to build a municipal electric plant, to be located on the Thompson River, 13 miles west of the city, or to accept the offer of the Greeley Hydro-Electric Co., Greeley, to deliver energy to the city at 1½ cents per kw-hr, provided the city installs a distributing system, or to furnish electricity to consumers at 8 cents per kw-hr.

HARTFORD, CONN.—The Connecticut Co. has applied to the Public Utilities Commission for approval of method of placing its electric feed wires in Hartford underground.

HARTFORD, CONN.—The Hartford Business Men's Association has offered a prize for artistic designs for lamp standards for the proposed ornamental street-lighting system to be installed here. The gas company as well as the electric company will compete for installation of the system.

WESTBROOK, CONN.—The Board of Selectmen has awarded a contract to the Essex Lt. & Pwr. Co., Essex, for street lighting for a period of five years, at $850 per year. The contract calls for 40 lamps of 40 cp.

NEWARK, DEL.—Negotiations have practically been closed whereby the Chester County Ltg. Co., Avondale, Pa., will lease the plant of the Elk River Ht., Lt. & Pwr. Co., located on the Elk River, near Cowentown, Md., connecting it with the system of the Chester County Co. The connection will be made near McClellandsville.

FORT PIERCE, FLA.—Bids will be received by the City Council until April 16 for the construction of water-works, sewers and electric-light system as follows: Erection of power house and pumping station; 500 tons of 6-in., 8-in. and 10-in. cast-iron pipe; 50 two-way hydrants; gate valves; 8000 ft. galvanized 1½-in. pipe; one duplex pump, with capacity of 750 gal. per minute; one duplex pump, 500 gal. per minute; one 100,000-gal. concrete reservoir; one 75,000-gal. tank upon 120-ft. tower; two 150-hp boilers; one 100-kva alternating-current generator; one 50-kva alternating-current generator; one four-panel switchboard, complete; erection of 7 miles of pole-line; 7 miles of 6-in., 8-in., 10-in. and 12-in. sewer pipe, also flush tanks and manholes, etc. Plans and specifications may be seen at the office of D. D. & C. M. Rogers, engineers, Fort Pierce. Copies of specifications will be forwarded upon receipt of $3.

MADISON, FLA.—The town has purchased the electric plant of the Madison Electric Pwr. Co., to be owned and operated by the municipality. Bonds to the amount of $30,000 have been issued to pay for same.

CHIPLEY, GA.—The city has engaged J. B. McCrary & Co., Atlanta, to take charge of the installation of an electric-light plant.

LA GRANGE, GA.—The Columbus Pwr. Co., Columbus, has been granted a franchise by the City Council to supply electricity here for manufacturing and industrial plants.

LAWRENCEVILLE, GA.—The City Council has engaged J. B. McCrary & Co., Atlanta, to take charge of construction of light, sewer and water systems. The cost of the work is estimated at $50,000.

MANCHESTER, GA.—J. B. McCrary & Co., of Atlanta, have been engaged by the Council to take charge of the construction of the proposed electric-light and power plant here, for which bonds to the amount of $15,000 have been issued

OCILLA, GA.—J. B. McCrary & Co., Atlanta, have been engaged by the city to take charge of the installation of the municipal electric-light plant.

VIDALIA, GA.—The city contemplates extensions to the municipal electric-light plant. An engineer has been engaged to prepare estimates for same.

IDAHO FALLS, IDAHO.—At an election held March 13 the proposition to issue $35,000 in bonds for the purpose of completing the city hydroelectric plant was carried.

IDAHO FALLS, IDAHO.—A proposition has been submitted by an Eastern syndicate to build and equip an electric railway from Idaho Falls to various points in the valley, provided the residents along the route subscribe for $40,000 of the stock. The entire right-of-way has been secured.

BARRY, ILL.—The Barry El. Lt. & Pwr. Co. is preparing to ask the City Council for a new franchise.

BLOOMINGTON, ILL.—The business men and property owners on South Center Street have decided to install an ornamental street-lighting

system, for which $2,000 has been raised. The plans call for the erection of 18 ornamental lamp standards.

BUSHNELL, ILL.—The City Council has granted the People's Service Co. a 25-year franchise to operate an electric-light plant and has awarded the company a contract for street lighting for a period of 13 years. M. M. Pinckley, Bushnell, is president.

CANTON, ILL.—The Commercial Club is interested in a project to extend the ornamental lighting system to the east and north sides of the public square.

CHICAGO, ILL.—The Chicago & Milwaukee El. R. R. Co. will soon issue $4,500,000 in bonds, of which $2,116,000 will be used to retire outstanding bonds and certificates and the remainder for improvements and extensions to its system.

CHRISMAN, ILL.—The Georgetown El. Co., Georgetown, has purchased the distributing system and franchise of the Chrisman Lt. & Wtr. Co. and will build a transmission line from its power plant at the Shoran mine, near Georgetown, to Chrisman to supply electricity to operate the local system.

DIXON, ILL.—Plans are being considered for further consolidation of electric light and power systems in Northern Illinois. The properties under consideration are located mainly along the Rock River and $2,800,000 has been offered for them. It is expected that they will be taken over by a London syndicate. Among the companies to be taken over are the Sterling Gas & El. Lt. Co., which operates in Sterling and Rock Falls; the Lee County Ltg. Co. at Dixon, and the Sterling, Dixon & Eastern El. Ry. Co., which operates an 18-mile interurban and city railway in Dixon and Sterling. Other concerns scattered along the river at Oregon and Belvidere are in the deal.

FREEPORT, ILL.—Plans are being prepared by the Freeport Ry. & Lt. Co. for rebuilding the distributing system during the coming summer and fall, at a cost of about $50,000. It is proposed to remove all electric wires from Stephenson and Galena Streets and erect them along the alleys.

GREENVILLE, ILL.—The Greenville El. Lt. & Pwr. Co. is contemplating extending its transmission lines to Mulberry Grove to supply electricity in that town.

HAMPSHIRE, ILL.—The Public Service Corporation of Illinois has purchased the local electric plant, owned by Louis Koth, including the franchise in the village of Huntley, recently acquired by Mr. Koth.

HILLSBORO, ILL.—The Hillsboro El. Lt. & Pwr. Co. has been awarded a contract to light the streets of Taylor Springs, a suburb, furnishing 50 incandescent lamps of 60 cp at $24 each per year

HILLSBORO, ILL.—The County Commissioners have entered into a contract with the Hillsboro El. Lt. & Pwr. Co. for lighting the Montgomery County poor farm with electricity. The company is to receive $626 for erecting its transmission line to the county farm and 15 cents per kw-hr for service up to 15 kw-hr, and for all above that amount 10 cents.

LACON, ILL.—The installation of an ornamental street-lighting system in the business district is under consideration.

MANITO, ILL.—The installation of an electric-light plant is said to be under consideration by the village authorities.

PERU, ILL.—The Citizens' Ltg. Co., La Salle, has applied to the City Council for a franchise to erect transmission lines for the distribution of electricity for lamps and motors here.

VILLA GROVE, ILL.—The Villa Grove El. Co. has increased its capital stock from $15,000 to $50,000.

ANDERSON, IND.—The Central Ht. & Lt. Co., successor to the Home Htg. Co., has applied to the City Council for a franchise to install a steam-heating plant and to supply electricity for lamps, heat and motors.

FAIRMONT, IND.—Arrangements are being made by the Marion Lt. & Htg. Co. to establish a 24-hour service for lamps and motors in Fairmont. L. O. Wallace is local manager.

KENDALLVILLE, IND.—Three propositions have been submitted by F. H. Froelich, city engineer, to the City Council for improvements to the municipal electric-light plant. The first called for an entirely new plant, the second for purchasing energy from the Toledo & Chicago Interurban Ry. Co., to be transformed at the municipal plant for distribution, and the third for securing the power direct from the traction company.

LAPORTE, IND.—The installation of an electric-light plant as well as heating plant is included in the plans for the Rumely Hotel, which are now being prepared. The proposed plant is to supply electricity for the building of the Laporte Tel. Co. and the Masonic Temple as well as for the hotel.

LOGANSPORT, IND.—The municipal electric-light plant was put out of commission by the breaking of the dam on the Eel River, which furnished power to operate the plant. Considerable damage was done to the equipment.

PLYMOUTH, IND.—The Commissioners of Marshall County are reported to have granted Harry Sane a franchise to erect and operate an electric transmission line between Plymouth and Culver.

RUSSIAVILLE, IND.—Plans are being considered for the installation of an electric-light system in Russiaville. The service will be supplied by the Kokomo, Frankfort & Western Trac. Co., Kokomo.

SOUTH BEND, IND.—Plans are being prepared by the Central Union Tel. Co. for extensions and improvements to its system in this vicinity which will involve an expenditure of about $80,000 and include additions to switchboard, central-station equipment, cable and pole-line work. Edgar Bonds is general manager.

WESTFIELD, IND.—Preparations are being made for the erection of a new lighting plant here.

ANAMOSA, IA.—A franchise has been granted to F. J. Cross, Central City, to supply electricity for lamps and motors here.

AUDUBON, IA.—A project is under way for the organization of a new company for the purchase of the old electric plant and installation of a new system to supply electricity for lamps, heat and motors here.

FORT DODGE, IA.—Arrangements have been completed by the Central Iowa Lt. & Pwr. Co. for the installation of a new 500-kw turbine at its main plant and the erection of a duplicate transmission line from the power station at Fraser to Fort Dodge. The company proposes to supply electricity to industrial plants in and around Fort Dodge. Mortimer Silverman is manager.

MADRID, IA.—The Madrid El. Lt. & Pwr. Co. is planning to establish a 24-hour service. The Madrid company is negotiating with the Boone El. Co., Boone, with a view to securing energy to operate the local system.

POMEROY, IA.—The installation of a municipal electric light and power plant is being agitated.

PORTSMOUTH, IA.—The local electric-light plant, owned by M. J. Coughlin, has been purchased by Peter Herkenrath and G. S. Bendon. The new owners contemplate remodeling the system.

SHELDON, IA.—M. F. Logan has applied to the Council for a franchise to construct and operate an electric-light plant here.

VILLISCA, IA.—At an election to be held April 15, the proposition to issue $10,000 in bonds, the proceeds to be used to purchase the local electric light plant or build a new plant, will be voted on.

LEAVENWORTH, KAN.—The Leavenworth Lt., Ht. & Pwr. Co. contemplates making improvements to its plant during the coming summer.

MINERAL, KAN.—J. E. Gallagher, city clerk, writes that the city will not vote on the proposition to issue bonds for the installation of a municipal electric-light plant, but is anxious to grant a franchise to private parties. Negotiations have been under way to grant a franchise, but satisfactory arrangements have not yet been made.

PAWNEE ROCK, KAN.—The Pawnee Rock El. Lt., Pwr. & Ice Co. is planning to install an electric-light plant and ice plant here. The directors of the company are: F. C. Woodbury, B. H. Bowman, O. M. Williamson, B. C. Uhruh, Roy French, A. M. Peters and Earl Bowman.

LEITCHFIELD, KY.—The City Council has awarded the contract for the installation of an electric-light plant to W. T. McCaskey, representing the Seager Engine Works, Lansing, Mich. About 40 street lamps will be installed.

LOUISVILLE, KY.—The Louisville Ltg. Co. has recently extended its transmission lines to the towns of Buechel and Lyndon and is making arrangements to extend its service to Anchorage.

ELTON, LA.—Efforts are being made by parties from New Orleans to secure a franchise to establish an electrc-light plant here.

NEW ORLEANS, LA.—The Southwestern Trac. & Pwr. Co. has awarded the contract for the construction of its new power house, to be located about 3 miles from New Iberia, to Jerry & Taylor.

DEXTER, MAINE.—The Central Maine Pwr. Co. is erecting a new transformer station on Water Street.

WARREN, MAINE.—The Selectmen have granted the Knox County Pwr. Co. permission to erect transmission lines here to supply electricity for lamps and motors.

BALTIMORE, MD.—Plans and estimates of cost are being prepared by E. B. Whitman, engineer of water works, for the construction of a hydroelectric plant in connection with the proposed high dam to be built in the Gunpowder Valley, about 7 miles from the city. The plant will be designed to supply electricity for lighting the streets and public buildings.

BALTIMORE, MD.—A bill will be introduced into the State Legislature incorporating the Baltimore & Eastern Shore Ry. Co. The company will be capitalized at $10,000,000 and proposes to construct a high-speed electric railway from Baltimore to Bay Shore, to ferry cars from there across the bay to Kent County, and to extend lines through the peninsula.

HAGERSTOWN, MD.—Plans are being prepared for the construction of an electric railway from Martinsburg to Williamsport, to connect at Williamsport with the Hagerstown Railway system.

BOSTON, MASS.—Mayor Fitzgerald has requested the City Council to appropriate $28,000 for the installation of a new power plant at the Suffolk School for Boys on Rainsford Island.

FALL RIVER, MASS.—The power house on the Slade's Ferry bridge, which furnished power for operating the bridge draw, was destroyed by fire on March 12. All the equipment, including dynamo, etc., was destroyed.

HUDSON, MASS.—Plans are being prepared by George A. Brothers, superintendent of the municipal electric-light plant, to replace the arc

lamps on Main Street with incandescent lamps and to extend the lighting system in different parts of the town.

SOUTHBRIDGE, MASS.—The Selectmen are considering the question of having the overhead wires on Main Street placed underground.

SOUTH FRAMINGHAM, MASS.—The committee appointed to investigate the advisability of establishing a municipal electric plant has reported in favor of the proposition. The question will be submitted to a vote before further steps are taken.

WARE, MASS.—The Ware El. Co. has increased its capital stock from $40,000 to $57,000.

WEBSTER, MASS.—The Selectmen are said to be in favor of changing the present arc-lamp street-lighting system for tungsten lamps. An appropriation of $11,000 has been asked by members of the board of street lighting. Four tungsten lamps may be had for the price of one arc lamp. The street-lighting service is furnished by the Westboro & Southbridge Gas & El. Co.

WESTFIELD, MASS.—The proposition to provide funds for extending the street-lighting system to the north side of the river and for new pavements will be submitted to the voters at the April town meeting.

WORCESTER, MASS.—The County Commissioners have decided to light the Summer Street jail by electricity instead of gas. The cost of the work is estimated at $2,500. Electricity will be furnished by the Worcester El. Lt. Co.

CHARLOTTE, MICH.—Arrangements are being made for the erection of a high-tension transmission line between Charlotte and Battle Creek by the Commonwealth Pwr. Co. The proposed line will be carried on towers and will connect the power house at Battle Creek and the plant at Au Sable dam.

DOWAGIAC, MICH.—The engine room and electric power plant and switchboard of the Round Oak Stove Works were destroyed by fire recently.

EVART, MICH.—The City Council has granted the Evart Lt. & Pwr. Co. a 20-year franchise to supply electricity for lamps and motors here. John S. Haggerty and others, of Detroit, are interested in the company.

GRAND RAPIDS, MICH.—Plans have been prepared for the installation of the boulevard lighting system on Bridge Street bridge, to cost $1,200.

GRAND RAPIDS, MICH.—The City Council has appointed a committee to make investigations with a view to the city building a municipal hydroelectric plant.

GRAND RAPIDS, MICH.—The Grand Rapids-Muskegon Pwr. Co. will extend its service to North Park and Comstock Park this season if necessary permits can be obtained from the townships of Grand Rapids, Plainfield and Walker for the erection of its transmission line.

HUDSON, MICH.—Three propositions for lighting the city have been submitted to the Board of Aldermen by the Hudson El. Lt. Co. for a period of ten years. One proposition includes discarding the arc lamps in the business section and erecting ornamental lamp standards.

TRAVERSE CITY, MICH.—A special election will soon be held to vote on the proposition to issue $150,000 in bonds to purchase the plant and holdings of the Queen City El. Lt. & Pwr. Co., to be owned and operated by the city.

DASSEL, MINN—Steps have been taken toward the installation of an electric-light system in Dassel. The service may be supplied by the municipal electric plant in Litchfield; if not, a private company will probably be formed to install a plant.

MORRIS, MINN.—M. B. Lord has applied for a franchise to install an electric-light plant here.

WARREN, MINN.—The Council is contemplating the establishment of a municipal electric-light plant.

MERIDIAN, MISS.—The Meridian Lt. & Ry. Co. will soon begin work on several extensions to its system in Meridian.

YAZOO CITY, MISS.—Proposals will be received by the Public Service Commission, Yazoo City, Miss., until April 27 for furnishing machinery and equipment, including steam turbine-driven alternating-current units, exciter units, railway converters, motor-generator sets, switchboard panels, condensers, etc. Specifications and further information may be obtained on application to the Public Service Commission.

DEARBORN, MO.—The St. Joseph Street Ry., Lt., Ht. & Pwr. Co. has applied to the City Council for a franchise to operate an electric system here.

FALLON, MO.—The city is planning to install an electric-light plant, for which $15,000 in bonds has been issued.

RICH HILL, MO.—The city contemplates enlarging the municipal electric-light plant and probably will be in the market for a boiler and other machinery.

ST. LOUIS, MO.—The Dorris Motor Co. is planning to build a new power plant in connection with its establishment on Sarah Street and Laclede Avenue, to cost about $7,200.

TWIN BRIDGES, MONT.—The Town Council has acted favorably on the proposition to light the streets of the town with electricity. It is expected that a contract will soon be entered into with the Madison River Pwr. Co.

HASTINGS, NEB.—The City Council has adopted the design for electroliers to be used for the ornamental street-lighting system. Property owners will provide the standards and the city will bear the expense of conduit and wire construction.

LINCOLN, NEB.—The City Council has adopted a resolution authorizing the light commissioner and the city engineer to prepare plans and specifications for a complete lighting system for the city of Lincoln.

NELSON, NEB.—The question of taking over the property and franchises of the Nelson Lt., Pwr. & Htg. Co., to be operated in connection with the municipal water plant, is under consideration. The city officials have been authorized to prepare estimates of the cost of a new plant if satisfactory arrangements cannot be made with the company.

CHURCHILL, NEV.—Bonds have been sold for the installation of an electric-light system. Churchill has not a post office.

GARDNERVILLE, NEV.—Investigations are being made by George L. Campbell, manager of the Truckee River General Electric Co., in the section adjacent to Waterloo and Centerville with a view of extending the transmission lines of the company to that territory.

SPRINGFIELD, N. J.—The Morris County Trac. Co., Morristown, contemplates the installation of an electric-lighting system on the principal thoroughfares of the town, plans for which have been submitted to the township committee.

BROOKLYN, N. Y.—Proposals will be received by the Department of Public Charities, foot of East Twenty-sixth Street, New York, until April 2, for furnishing all labor and material for extension of main heating tunnel, addition to heating and power plant, construction of sewer main and installation of electric feeders for power and light at Kings County Hospital, borough of Brooklyn. Blank forms and further information may be obtained at the office of Frank J. Helmle, architect, 190 Montague Street, borough of Brooklyn, where plans and specifications may be seen. Michael J. Drummond is commissioner.

OSSINING, N. Y.—The Hudson River & Eastern Trac. Co. contemplates building an extension from Ossining to White Plains, a distance of 16 miles.

RICHMOND, N. Y.—Bids will be received at the office of the president of the borough of Richmond, Borough Hall, St. George, New Brighton, N. Y., until April 2, for furnishing one electric street-flushing machine with appurtenances. Blank forms, together with copy of contract, including specifications, may be obtained upon application to the above office. George Cromwell is president.

WATKINS, N. Y.—The Board of Water, Sewer and Light Commissioners is contemplating establishing a 24-hour electric service.

KERNERSVILLE, N. C.—The proposition to issue $5,000 in bonds for the installation of an electric-light plant will be submitted to the voters on April 9.

CINCINNATI, OHIO.—The Mount Adams Improvement Association is considering the question of installing street lamps in that district.

MIDDLETOWN, OHIO.—A movement has been started by several residents on Main Street to secure cluster lamps for Main and other streets.

NELSONVILLE, OHIO.—John A. Stewart, owner of the Stewart El. Co. and the Hocking Pwr. Co., both of Nelsonville, has filed a joint petition with the State Public Service Commission asking that the latter be allowed to issue $50,000 additional capital stock.

PANDORA, OHIO.—The D. C. Shank Co. has been granted a franchise to construct and operate an electric-light plant here.

VAN WERT, OHIO.—The Ohio El. Ry. Co. has applied to the City Council for a franchise to erect transmission lines to supply electricity for lamps and motors here. The city clerk was directed to call for bids for lighting the streets of the city.

ARDMORE, OKLA.—The Ardmore, Duncan & Lawton Ry. Co. has completed the surveys for its proposed electric railway between Ardmore, Duncan and Lawton, a distance of 100 miles. Work will begin on construction of the road about May 1. J. L. Hamon is president.

FLORENCE, ORE—At an election held on March 11 the proposition to grant a franchise to G. G. Bushman to construct and operate an electric-light plant was carried.

FREEWATER, ORE.—The Pacific Pwr. & Lt. Co. has announced that it will erect a transmission line from Freewater to Vincent and from there to Meadow Park, 15 miles long, as soon as 100 hp is contracted for by ranchers along the line. C. S. Walters is manager.

MARSHFIELD, ORE.—Plans are being considered by the C. A. Smith Co. and the Smith-Powers Logging Co. for the construction of an electric plant at the Smith mill, Marshfield. The plant will supply electricity for the electric logging apparatus which is to replace the steam donkey engine in the logging camps, and also to supply electricity for the mill and probably for the terminal railway.

ALLENTOWN, PA.—Barr & Bachman, electrical contractors and engineers, of this city, it is reported, contemplate the construction of an electric plant to supply electricity for lamps and motors for residences located between Kempton and New Tripoli.

DRAVOSBURG, PA.—The Dravosburg Dock Co., which operates large dry docks on the Monongahela River, near here, has decided to install motor-driven pumps for emptying the chambers of the docks. About 20 pumps will be required.

EASTON, PA.—The City Council has adopted a resolution authorizing the superintendent of the Water and Light Department to look into the

advisability of the city of Easton supplying electricity for commercial lighting.

ELDORADO, PA.—The Penn Central Lt. & Pwr. Co., Altoona, has commenced work on the erection of a transmission line to Eldorado for the purpose of supplying electricity here.

GOLDSBORO, PA.—Plans are being considered for the installation of an electric-light system here. John E. Graybill has been appointed to negotiate with the York Haven Wtr. & Pwr. Co. with a view of having the company extend its lines to this town. Post office address, Etters, Pa.

LEBANON, PA.—The Lebanon El. Lt. & Pwr. Co. has applied to the City Council for a franchise to construct and operate an electric system here.

NEW BENTON, PA.—The citizens of New Benton have petitioned the Commissioners of Swatara Township to take necessary steps to light one or more of the thoroughfares leading from New Benton to Steelton. Post office address is Bressler.

PEN ARGYL, PA.—The Slate Belt El. St. Ry. Co. contemplates enlarging its power house to provide room for additional equipment.

PITTSBURGH, PA.—The Bruckman Lumber Co. is planning to discard its steam power plant and equip its plant for electrical operation. Bids have been asked for the installation of necessary equipment to operate 26 woodworking machines. The change will involve an expenditure of about $4,000. About 215 hp will be required, which will be secured from a local electric light company.

SCRANTON, PA.—The Scranton & Binghamton Trac. Co. contemplates the purchase of a portable substation, which will be placed on its Lake Winola branch.

UNIONTOWN, PA.—The Borough Council has awarded the West Penn El. Co. a contract for street lighting for a period of five years, at $70 per arc lamp per year.

WILKINSBURG, PA.—The City Council has authorized the installation of 21 flaming-arc lamps, manufactured by the Westinghouse El. & Mfg. Co.

WYOMISSING, PA.—Proposals will be received by the Borough Council until April 11, for lighting certain streets of the borough with incandescent lamps for three-year, five-year and ten-year periods, beginning June 1, 1912. Specifications, etc., may be obtained on application to Charles M. Huber, secretary of Council.

MANILA, P. I.—The Manila El. R. R. & Lt. Co. contemplates the construction of about 6½ miles of new track during 1912.

FARMER, S. D.—The citizens are considering the question of securing an electric-light system for Farmer.

FLANDREAU, S. D.—The City Council has granted the Ladd El. Lt. Co. a franchise to install an electric-light system in Flandreau.

GARRETSON, S. D.—The installation of an electric-light plant here is being promoted by Emil Benson.

PIERRE, S. D.—The State Capitol Commission has awarded the contract for the installation of electric-light system and conduits on the Capitol grounds to the Pierre El. Co., for $5,580. About 60 lamp standards carrying five lamps each will be erected.

WAKONDA, S. D.—Preparations are being made for the erection of a new electric-light plant here.

DALLAS, TEX.—Plans are being considered for the installation of an isolated electric plant at the county court house. The proposed plant would supply electricity for pumping water from the well in the court house and county jails and for lamps for the Dallas-Oak Cliff viaduct and for the West Dallas pike.

DUBLIN, TEX.—Thomas McDonald, P. O. box 42, Dublin, Tex., would like to receive prices on a 16-in. x 36-in. high-speed Corliss engine and a 150-kw generator, direct-connected, or a 250-hp turbine engine with 150-kw generator, direct-connected.

FORT WORTH, TEX.—The Northern Texas Trac. Co. contemplates the installation of a 5000-kw turbine at the Handley power plant and double-tracking the railway between Fort Worth and Handley.

HARLINGER, TEX.—Contracts have been awarded for the new city water and electric-light plant, work on which will begin at once. Randall-Lovegrove-Wymann, engineers, Houston, have charge of the work.

HOUSTON, TEX.—The Southwestern Tel. & Teleg. Co. has purchased the properties of the Cleveland Tel. Co., the Sabine Valley Tel. Co., the Yellow Pine Tel. Co. and the Longview Tel. Co. in east Texas. Extensions and improvements will be made to the system. J. E. Farnsworth is vice-president and general manager of the Southwestern company

PROVO, UTAH.—A company has been organized by residents of Leland for the purpose of establishing an electric light and power plant and telephone system. The company is capitalized at $10,000 and the officers are: Benjamin Isaacs, president; Arthur Snow, vice-president, and Perry A. Thomas, secretary and treasurer.

SALT LAKE CITY, UTAH.—The Utah Lt. & Ry. Co. is planning to extend its Sugar House line to Holliday; also an extension from the new high school site at Ninth Street south of Fifteenth Street to a connection with the present Sugar House line terminus.

SALT LAKE CITY, UTAH.—Plans have been prepared for the installation of an ornamental street-lighting system on several blocks on Fifth East Street and State Street. The cost is estimated at $1,700 per block. The Utah Lt. & Ry. Co. has agreed to install the system at its own expense if assured a certain number of connections.

SWANTON, VT.—The Village Trustees have awarded a contract to the Fort Wayne El. Co. to install an incandescent street-lighting system, using tungsten lamps.

CLIFTON FORGE, VA.—Judge George K. Anderson has issued an order for holding an election to submit a proposition to the voters as to whether the city shall issue $190,000 in bonds to purchase the property and holdings of the Clifton Forge Lt. & Wtr. Co., to be owned and operated by the municipality.

LYNCHBURG, VA.—The Lynchburg Trac. & Lt. Co. contemplates an extension to its street railway system and some double tracking in Lynchburg.

ALBION, WASH.—J. F. Kenoyer has applied for a franchise to construct and operate an electric system here. The mill property and dam above the town were recently purchased by Mr. Kenoyer.

BELLINGHAM, WASH.—The Board of County Commissioners has granted the Whatcom County Ry. & Lt. Co. a franchise to erect a transmission line over the Guide Meridian road to the boundary, there to connect with the Western Canada Pwr. Co.

CHARLESTON, W. VA.—The Triple-State El. Co., 16 McFarland Street, Charleston, is in the market for a 125-kw or 150-kw, 250-volt generator, rheostat and ammeter; also for a 225-hp engine for same, direct-connected or belted, second-hand.

EAU CLAIRE, WIS.—The construction of an electric railway from Eau Claire to Altoona is contemplated by the Chippewa Valley Ry., Lt. & Pwr. Co. this year.

LA CROSSE, WIS.—The La Crosse Gas & El. Co. has filed a trust deed covering all of its property to secure an issue of $3,000,000 in bonds, to enable the company to refund outstanding indebtedness of $1,100,000 and to provide funds for extensions and improvements.

MILWAUKEE, WIS.—All bids for the installation of permanent lamps on the new Grand Avenue viaduct were rejected. The lowest bid submitted was $95,000.

MILWAUKEE, WIS.—The Milwaukee Western El. Ry. Co. is planning to build an electric railway between Milwaukee and Fox Lake and another from Sussex on the main line to Waukesha, making a total of about 74 miles of track.

POTOSI, WIS.—The Union El. Co., of Dubuque, Ia., has submitted a proposition to local business men, offering to erect a transmission line from Dubuque to Potosi to supply electricity for lamps.

TWO RIVERS, WIS.—Plans are being considered for rebuilding and enlarging the municipal electric-light plant.

CALGARY, ALTA., CAN.—J. T. Child, city engineer, has recommended the purchase of 140 magnetite arc lamps of 2000 cp and 464 ornamental lamp standards, each carrying 400 cp, to cost $10,497.

CALGARY, ALTA., CAN.—The City Commissioners have decided to recommend to the City Council that a by-law to appropriate $100,000 for extension to the underground conduit cable system for electric-light wires be drawn up and submitted to the ratepayers.

WINNIPEG, MAN., CAN.—Plans have been prepared by the Winnipeg El. Ry. Co. for the extension of its Winnipeg-Selkirk line to Stony Mountain and Stonewall, starting from near Middle Church.

ARKONA, ONT., CAN.—Preparations are being made by the London & Northwestern Ry. Co. for construction of a dam and power plant at Rock Glen, near Arkona. Smith, Kerry & Chace, Toronto, are engineers in charge.

HAMILTON, ONT., CAN.—The Hydro-Electric Department has decided to use cement lamp standards for the street-lighting system, for which tenders will be called as soon as the number of posts needed has been decided upon. Tenders will also be asked for incandescent lamps needed by the department for the city hall and other municipal buildings.

KINGSTON, ONT., CAN.—The Utilities Committee has decided to enter into negotiations with the Seymour Pwr. Co., Campbellford, with a view of entering into a contract for power.

LONDON, ONT., CAN.—The London & Lake Erie & Trans. Co. contemplates securing power from the Hydro-Electric Power Commission to operate its system.

LONDON, ONT., CAN.—Two propositions have been submitted to the City Council for lighting the city. The London El. Co. has offered to supply the service in accordance with the present lighting system for $22,000 per year, which is now furnished by the Hydro-Electric Power Commission at an estimated cost of about $25,000 annually. It also agrees to extend the system at the same rate per kw. This proposition includes the use of the municipal street-lighting system. The Hydro-Electric Power Commission offers to extend the ornamental lighting system, now confined to the downtown section, and also to extend the regular lighting system in the residential districts for $36,000 per year. The London El. Co. asks for a five-year contract.

NIAGARA FALLS, ONT., CAN.—Steps have been taken by the city to secure permission from the provincial government and the Queen Victoria Park Commission to erect a new power house and pumping station. The plans call for the installation of four generators, waterwheels, pumps,

penstocks, etc, at the bottom of the shaft. It is proposed to develop about 4000 hp near the site of the present pumping station.

OTTAWA, ONT., CAN.—Plans have been prepared for the construction of a conduit system for electrical wires. The Lighting Department contemplates the installation of an ornamental lighting system.

SASKATOON, SASK., CAN.—The Hoeschen Wentzleu Co. contemplates enlarging its power plant at its brewery in Nutana, at a cost of about $20,000. Generators and mechanical equipment will be installed.

## New Industrial Companies

THE ANDERSON LIGHT & SPECIALTY COMPANY, of Chicago, Ill., has been incorporated with a capital stock of $40,000 for the purpose of manufacturing gas and electrical supplies. The incorporators are: Andrew A. Anderson, Gratia S. Anderson and Hugh A. Caperton.

THE FALLON COMPANY, of Rochester, N. Y., has been incorporated with a capital stock of $25,000 for the purpose of manufacturing electric signs. The officers are: Wilmer Fallon, president; Herman Tusch, vice-president, and D. Edward Strauss, secretary and treasurer.

THE FREDERICK W. KING COMPANY, of Buffalo, N. Y., has been granted a charter with a capital stock of $25,000 by Frederick K. and Louis King and Edward D. Strebler. The company proposes to do a general civil, mechanical and electrical engineering business.

THE LORBEER ELECTRICAL SUPPLY COMPANY, of Los Angeles, Cal., has been incorporated with a capital stock of $25,000 by A. W. Cleaver, E. G. Lorbeer, J. Irving and E. G. Alexander. The company proposes to do a general electrical supply business

THE O. K. INCANDESCENT LIGHT COMPANY, of Youngstown, Ohio, has been chartered with a capital stock of $2,500 to manufacture gas, electric light and heating appliances by C. A. Manchester, Leroy A. Manchester, Dudley R. Kennedy, S. S. Conroy and L. M. Montgomery.

THE SOUTHERN ENGINEERING & ELECTRIC COMPANY, of Charleston, S C., has been incorporated with a capital stock of $50,000 to carry on an electrical machinery business, etc. The incorporators are: Benjamin P. Foster, Wilmington, Del.; Charles F. Middleton and Alfred Huger, both of Charleston.

THE WARREN ENGINEERING COMPANY, of Terre Haute, Ind., has been incorporated with a capital stock of $25,000 for the purpose of constructing light, gas and water plants; also electric railways, etc. The directors are: W. P. Ijams, J. W. Ijams and G. E. Bowman.

## New Incorporations

OAKLAND, CAL.—The National Pwr. Co. has filed articles of incorporation with a capital stock of $10,000,000 for the purpose of acquiring water rights and to generate and distribute electricity. The directors are: Leon M. Gove, H. L. Breed, Charles Grose, J. E. Bowes and E. A. Herrman, all of Oakland

SAN FRANCISCO CAL.—Articles of incorporation have been filed for the Coast Valleys Gas & El. Co., with a capital stock of $5,000,000, by H. A. Thornton, Berkeley; John F. Forbes, Alameda; F. W. Geiger, G. V. Matthews, San Francisco, and A. R. Franklin, Sausalito.

SAN FRANCISCO, CAL.—Articles of incorporation have been filed for the Butte & Tehama Pwr. Co., with a capital stock of $1,000,000, for the purpose of operating plants to generate electricity and gas. The directors are: Luke McDonald, L. A. McIntosh, R. L. Kittrick, J. E. Frick and Leon Bly.

BOSWELL, IND.—The Citizens' Wtr. & Lt. Co. has been incorporated with a capital stock of $10,000 for the purpose of supplying water and light here. The directors are: J. F. Brubaker, A. M. Bristow and W. B. Waddell.

HOPKINSVILLE, KY.—The Kentucky-Tennessee Trac. Co. has been incorporated with a capital stock of $1,000,000 to build an electric railway from Evansville, Ind., to Nashville, Tenn. Work will begin at once upon the Hopkinsville-Guthrie section, 28 miles long. The officers are: Nathan Gaithers, president; J. W. Cross, vice-president; H. A. Keach, secretary, and A. H. Eckles, treasurer, all of Hopkinsville.

HIBBING, MINN.—The Mesaba El. Ry. Co. has been incorporated under the laws of the State of Maine with a capital stock of $3,750,000 to build a high-speed interurban railway on the Mesaba range, between Hibbing and Gilbert. Charles M. Drummond is president and G. M. Horne treasurer. Robert W. Watson, of New York, vice-president of the Great Northern Pwr. Co., of Duluth, is a member of the advisory committee.

SPRINGFIELD, MO.—Articles of incorporation have been filed for the Mississippi Valley Interurban Ry. Co. for the purpose of operating an interurban railway system, which will include Springfield, Petersburg, Rushville, Mount Sterling, Quincy, Pittsfield, Hardin, Jerseyville, Hillsboro, Greenville, Shelbyville, Owanedo, Vandalia, Carlisle, Nashville and other places. The proposed road will connect with St. Louis through lines already constructed.

LEWISTOWN, MONT.—The Lewistown El. & Pwr. Co. has been incorporated with a capital stock of $1,000,000 for the purpose of taking over the property of the Citizens' El. Co. The directors are: Max Hebgen, F. M. Kerr, E. P. Pennebaker, S. Hogan, of Butte; W. J. Johnson, C. C. Somonson and R. von Tobel, of Lewistown.

NEW YORK, N. Y.—The One Hundred and Forty-fifth Street Crosstown R. R. Co. has been incorporated with a capital stock of $200,000 to operate a street railway in 145th Street from Lenox Avenue to Broadway. The directors are: Horace M. Fisher, Plainfield, N. J.; E. F. J. Gaynor, George Keegan, B. J. Pepperman, David Ross and David W. Ross, New York, N. Y., and others.

MIAMI, OKLA.—The Quapaw-Lincolnville Ry. Co. has been organized with a capital stock of $20,000 for the purpose of building an interurban railway to connect the two cities. The promoters are: J. D. McIntyre, J. L. McCracken, M. H. McCracken and George D. Stein, all of Miami.

BROWNSVILLE, TEX.—The Brownsville St. & Interurban Ry. Co. has been organized with a capital stock of $10,000 for the purpose of constructing a street-railway system in Brownsville. The company has taken over the franchise recently granted to S. A. Robertson, San Benito. The incorporators are: S. L. Dworman, Brownsville; H. L. Borden, Houston, and S. A. Robertson.

FRANKLIN, VA.—The Factory Hill Pwr. Co. has been incorporated with a capital stock of $5,000 and the following officers: C. C. Vaughn, president, and C. C. Vaughn, Jr., secretary and treasurer.

MANNINGTON, W. VA.—Articles of incorporation have been filed for the Mannington, Wadestown & Blacksville Ry. Co. with a capital stock of $50,000 to build an electric railway from Mannington to Blacksville, via Wadestown. The incorporators are: S. B. Harker, S. Clarke Steele, Wana; Samuel Eakin and M. J. Garrison, Wadestown, and E. C. Martin, Mannington.

## Trade Publications

ELECTRIC STOVES.—The Cadillac Electric Manufacturing Company, Cadillac, Mich., has issued an illustrated folder devoted to its combination stove and toaster. The device is so arranged as to allow broiling or frying to be done above the heater while toasting and broiling is being done in a drawer below, the two operations taking place simultaneously.

FAN MOTORS.—The Westinghouse Electric & Manufacturing Company has issued Folders 4100 and 4101, covering its 1912 line of fan motors. One of the folders is devoted to alternating-current fans and the other to direct-current fans. Attractive art covers add greatly to their appearance. The new line of steel-frame fans is well illustrated and described therein.

FEED-WATER HEATERS.—"Cochrane Heaters, Their Use in Steam-Power Plants for Heating and Purifying Water for Boiler Feed and Other Purposes," is a 144-page publication issued by the Harrison Safety Boiler Works, Philadelphia. The range of topics includes the choice of a system for heating boiler-feed water; the relative economies of electric and direct-driven auxiliaries versus steam-driven auxiliaries where the exhaust from the latter is used for heating the boiler-feed water; the action of spraying the water through a steam bath in driving off air and gases and thereby preventing corrosion as well as bringing about the precipitation of carbonates from the water; a comparison of the thermal efficiencies of direct-acting pumps, throttling plain slide-valve engines, automatic engines, compound engines and steam turbines; the effect upon fuel economy of heating boiler-feed water; the steaming capacity of boilers; apparatus for utilizing exhaust steam, including feed-water heaters, oil separators, traps, return tanks and automatic cold-water regulators; the influence of scale upon boiler repair bills; the heating of feed water in condensing plants; the utilization of exhaust steam for heating and drying work and for the operation of low-pressure turbines; the operation of open feed-water heaters in multiple; the pumping of hot water; the limitations of injectors; a point-by-point comparison of the efficiencies and other characteristics of open feed-water heaters; an analysis of the design of the several parts of an open feed-water heater; an analysis of the design of the several parts of an open feed-water heater; an analysis of the fundamental facts of water softening as it affects central stations, manufacturing plants, etc.; the metering of boiler feed-water, etc. The catalog also describes the many appliances manufactured by the Harrison Safety Boiler Works for use in connection with the above mentioned branches of engineering.

## Business Notes

S. SILVERBERG has opened an office at 512 Fifth Street, Washington, D. C., as an electrical constructor and supply dealer.

HABIRSHAW WIRE COMPANY announces the removal of its offices in New York City to the twenty-seventh floor of the Metropoliatn Tower.

REGINA ELECTRIC CLEANER.—The Regina Company, 47 West Thirty-fourth street, New York, is placing on the market a new type of electric cleaner to meet the demand for a machine, at a low price, which has a large arc displacement.

COOPER HEWITT SALES DEPARTMENT.—Mr. F. R. Fortune has been appointed to the newly created position of general sales manager of the Cooper Hewitt Electric Company. Mr. Burford Britton succeeds

him as district sales manager. The headquarters of both officials will be in the Westinghouse Building, Pittsburgh.

THE PRICE ELECTRIC COMPANY, 413 Sibley Street, St. Paul, Minn., announces that it has completed an arrangement with the Ideal Electric & Manufacturing Company, of Mansfield, Ohio, to represent the latter company. A large stock of "Ideal" motors, generators, etc., will be carried, and expert advice will be given on any problems relating to electric installations.

NEW PEERLESS LAMP AGENCY.—H. H. Kunde, well known in electrical circles in the Pittsburgh district and who for some time past has been connected with the Doubleday-Hill Company, has severed his connection with that company, to become manager of the Pittsburgh branch of the Peerless Lamp Works, Warren, Ohio. Mr Kunde has established headquarters at 2014 Jenkins Arcade.

WESTERN ELECTRIC AT NEW ENGLAND N. E. L. A. CONVENTION.—The Western Electric Company sent a large delegation to the New England Section N. E. L. A. convention at Springfield, Mass., last week, including Messrs. H. B. Gilmore, W. F. Abely, W. I. Jones, T. H. Oberman, M. C. Clark, J. C. Butts, C. H. Howes, W. B. Edgar, H. E. Dyas, N. I. Allen, W. B. Simpson and F. E. Watts.

NEW ELECTROSE PLANT.—The new plant of the Electrose Manufacturing Company, Brooklyn, N. Y., was started on March 25. The new plant is 50 per cent larger than the former plant, which was destroyed by fire several months ago, and will be worked night and day in order to catch up on orders. It is in the Robert Gair Building, adjacent to the Brooklyn Bridge, one of the most highly approved fireproof structures in the United States.

NEW SALES MANAGER FOR IDEAL ELECTRIC & MANUFACTURING COMPANY.—The Ideal Electric & Manufacturing Company, Mansfield, Ohio, announces that Mr. C. F. Succop has been made general sales manager of the company and will make his headquarters at the main office, Mansfield, Ohio. Mr. Succop has had many years' experience as a salesman of electrical apparatus and is an expert in problems involving the commercial adaptation of electric motors and generators.

HOXIE & GOODLOE.—Dr. George L. Hoxie, consulting electrical engineer, New York, and Mr. Meade Goodloe, designing mining engineer, Arizona, have opened engineering offices in the San Fernando Building, Los Angeles. Mr. Goodloe, as general manager of the Imperial Copper Company, designed, built and operated the 800-ton smelter at Sasco, Ariz., and controlled the company's mines, at Silver Bell, and about 30 miles of steam railroad. Dr. Hoxie, who is a member of the American Institute of Electrical Engineers, recently served as consulting engineer for the Board of Public Utilities in fixing the energy rates in Los Angeles.

EVIDENCE OF RETURN OF PROSPERITY.—The Diehl Manufacturing Company, Elizabethport, N. J., manufacturer of electrical motors and generators, has been compelled by a great influx of business to add 20,000 sq. ft. to its factory floor space and to fill every available nook and corner with special machinery. Commenting on this condition, the Diehl company says: "There is a wail of strikes and calamities, and of labor versus capital, of socialism against monopoly, all tending to confuse the judgment and influence the disposition of a worker toward his fellow-men, filling even the most optimistic with a chill of impending disaster. Does the fact that the Diehl company and many others are working overtime filter a ray of light into the discouraged brain? Where does all this 'poor business' talk originate?"

GARDINER PAINT COMPANY, New York, N. Y., manufacturer of Gardiner's anti-rust paint, has opened an office in the Plymouth Building, Minneapolis, Minn. Mr. Manfred A. Pakas, formerly with the Flour City Ornamental Iron Works, has been appointed Western agent of the concern. Special features of Gardiner's anti-rust paint are that it is an electrical insulator, affords protection from electrolysis and is not affected by acids or alkali. Robert W. Hunt & Company, the well-known engineers, have made a test of the paint and submitted a most favorable report. It has been used by the United States government on all its battleships for the last twenty years. It is being used in the Hotel Alpin, now in course of construction in New York City, which, it is stated, will be the largest hotel in the world when completed. It is also used by various steam and electric railroads.

# Weekly Record of Electrical Patents

UNITED STATES PATENTS ISSUED MARCH 19, 1912.

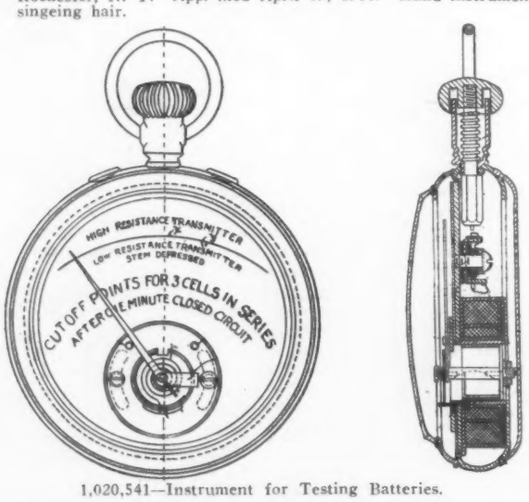
[Prepared by Robert Starr Allyn, 16 Exchange Place, New York.]

1,020,402. ELECTROMAGNETIC RECEIVING APPARATUS; J. B. M. P. H. R. d'Ivry, Paris, France. App. filed Sept. 5, 1907. Contact-retarding and current-distribution device.

1,020,411. TROLLEY POLE; J. Gaits, Jeannette, Pa. App. filed May 28, 1910. The trolley harp is screwed into the pole.

1,020,429. LIGHTNING ARRESTER; L. T. Lineberger, Gastonia, N. C. App. filed March 23, 1911. Carbon type.

1,020,439. ELECTRIC SINGEING INSTRUMENT; H. Y. Norwood, Rochester, N. Y. App. filed April 19, 1911. Hand instrument for singeing hair.


HIGH RESISTANCE TRANSMITTER
LOW RESISTANCE TRANSMITTER STEM DEPRESSED
CUT OFF POINTS FOR 3 CELLS IN SERIES AFTER ONE MINUTE CLOSED CIRCUIT

1,020,541—Instrument for Testing Batteries.

1,020,457. UNIVERSAL BINDING POST; A. K. Sloan, Jr., Brooklyn, N. Y. App. filed Feb. 27, 1911. Interior connection and adapted to receive an exterior clip.

1,020,479. ELECTRIC REGULATION; J. L. Creveling, New York, N. Y. App. filed Oct. 11, 1910. Automatic current control for a storage battery and generator system.

1,020,480. MEANS FOR PREVENTING CORROSION OF SURFACE CONDENSERS AND OTHER METAL STRUCTURES; P. E. G. Cumberland, Victoria, Australia. App. filed April 27, 1911. Electrolytic.

1,020,520. CIRCUIT-CLOSING APPARATUS; H. W. Sheehy, Akron, Ohio. App. filed May 25, 1910. For operating a track switch from a car.

1,020,541. INSTRUMENT FOR TESTING BATTERIES; C J. Davidson, Hackensack, N. J. App. filed Dec. 14, 1909. Pocket device with indicator.

1,020,546. PROCESS OF SMELTING ORES AND APPARATUS THEREFOR; R. Fleming, Westfield, N. J. App. filed May 23, 1910. Vertical charge feed with oppositely disposed electrodes.

1,020,555. SIGNAL; A. J. Horton, White Plains, N. Y. App. filed Feb. 1, 1909. Railroad block signal with main and reserve device.

1,020,565. METER FOR MEASURING ELECTRICAL CURRENTS; A. Loewenberg, Chicago, Ill. App. filed March 22, 1909. D'Arsonval type integral magnet and field pieces.

1,020,566. ELECTRIC MOTOR; J. F. and R. E. McKinzie and J. B. Clark, La Salle, Ill. App. filed May 3, 1911. The armature has no winding.

1,020,568. ALKALINE BATTERY; W. Morrison, Des Moines, Ia. App. filed Nov. 14, 1910. A positive pole with finely divided compound of copper mercury.

1,020,603. ELECTRICALLY HEATED TOOL; J. S. Hansen, Brockton, Mass. App. filed May 7, 1908. Treeing iron.

1,020,606. ELECTRIC DAMPER CONTROL; F. Huff, Napa, Cal. App. filed Dec. 7, 1910. For incubators, etc.

1,020,672. CONDUIT; J. S. Wilson, Chelsea, Mass. App. filed Dec. 27, 1909. A fish wire of sinuous form is provided in the tube.

1,020,688. INDUCTION FURNACE; R. Fleming, Lynn, Mass. App. filed Oct. 10, 1907. Self-regulating; the primary coil is movable.

1,020,698. ELECTROLYTIC INTERRUPTER; J. R. Kelley, Covington, Ky. App. filed April 21, 1911. A cell in which the parts are arranged and combined to prevent rapid deterioration and to provide for renewal of parts subject to wear.

1,020,732. REVERSIBLE LAMP BASE; T. A. Willard, Cleveland, Ohio. App. filed June 6, 1910. Plungers are arranged in pairs connected in multiple.

1,020,768. ALARM-SIGNAL DEVICE; R. H. Manson, Elyria, Ohio. App. filed May 10, 1911. Electromagnetic "noise horn."

1,020,794. TROLLEY; C. A. Bluhm, Michigan City, Ind. App. filed March 3, 1909. For a protected third-rail system.

1,020,818. ELECTRICAL SWITCH MEANS; H. L. Furr, Harrisonburg, Va. App. filed March 25, 1909. For central telephone exchange to avoid the use of cords and jack plugs. (Forty claims.)

1,020,826. RAIL BOND; F. E. Johnson, Chicago, Ill. App. filed July 24, 1911. The bond terminals are inserted in the head of the rail.

1,020,828. ELECTRIC WASHING MACHINE; W. D. Jones, New York, N. Y. App. filed Dec. 11, 1911. Electrolytic.

1,020,829. ELECTRIC WASHING MACHINE; W. D. Jones, New York, N. Y. App. filed Dec. 11, 1911. An electric circuit is passed through the washing liquid.

1,020,880. INSULATOR; A. M. Bourke, Maitland, New South Wales, Australia. App. filed July 26, 1910. Grooved pin type for telephone and telegraph wires.

1,020,898. TELEPHONIC APPARATUS; E. A. Graham, Brockley, England. App. filed July 28, 1910. Water-tight instrument all parts of which are mounted in a single casing.

1,020,942. LEVITATING TRANSMITTING APPARATUS; E. Bachelet, Mount Vernon, N. Y. App filed April 2, 1910. For transmitting mail and express matter at high speed.

1,020,943. LEVITATING TRANSMITTING APPARATUS; E. Bachelet, Mount Vernon, N. Y. App. filed April 21, 1910. Electromagnetic support with a shifting field.